Sixteenth Conference
of the
# Indian Mathematical Society
Madras 1949

## Souvenir Volume

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# Sixteenth Conference
# of the
# Indian Mathematical Society
## Madras, 1949

EDITED BY
D. V. RAJALAKSHMAN
*Lecturer in Statistics*
*University of Madras*

PUBLISHED BY
THE RECEPTION COMMITTEE

Considerable help has been received by me, in compiling this volume from various individuals and institutions. Among them, I wish to mention, first all contributors of articles who readily responded to my request in spite of their multifarious activities. I am equally thankful to the principals of colleges and heads of institutions for not only giving me information about their institutions, but also for sparing photo blocks for printing this souvenir. I am deeply grateful to the Chairman, Reception Committee for giving me full facilities and encouragement and to all others who helped me in preparing this volume. I wish to particularly thank the press for co-operating with me and printing this souvenir in the shortest possible time.

D. V. RAJALAKSHMAN

GOVERNOR-GENERAL'S CAMP
INDIA
Madras, 18th December 1949

Mathematics is the devoted and unerring care-taker of all the Sciences. May India add to her past mathematical glory by fresh activities in this classic field of research.

C. RAJAGOPALACHARI

Government House
Guindy
21st December 1949
Madras

## MESSAGE

As Patron of the Reception Committee and also as Chancellor of the Madras University, it is a privilege and pleasure to welcome the delegates of the Sixteenth Conference of the Indian Mathematical Society which is to be held at Madras during the last week of December. Madras has become the venue of this Conference after a lapse of thirty years.

We are living in an Age in which Science plays an important part in shaping the destinies of Nations. Everyone knows the value of scientific knowledge in the present context of world administration.

I would like to congratulate the Society on their enterprise and I trust that the deliberations of the Conference will help towards the advancement of Mathematical knowledge in this country.

I wish the Conference every success.

KRISHNA KUMARSINHJI BHAVSINHJI
*Governor of Madras*

## FOREWORD

This souvenir volume is intended to give the reader a glimpse of the historical and cultural background of the city which has been given the privilege of welcoming the distinguished delegates to the Sixteenth Conference of The Indian Mathematical Society. Partly because of its geographical position and partly because of its backwardness as a great city of trade, commerce or industrial development, Madras has been, till recently, rarely included in the itinerary of vistors to India. To those however, who are interested in academic work, it is our hope that Southern India in general, and Madras in particular will not be uninteresting.

This souvenir contains interesting articles about the origin and development of the Indian Mathematical Society, of that great genius, Ramanujan, whose premature demise is a great and irreparable loss to the world of Mathematicians and on the contributions to Mathematical thought from South India.

It was a happy idea to have included in the souvenir, contributions from experts in their own field on a wide variety of subjects of interest to the public. These articles deal with some of the educational activities of Madras, the history of the city and the great temples of Southern India. To the student of Mathematics, the architectural beauty of these ancient shrines should afford ample scope for reflection and should enable him to realise the extent to which a knowledge of Mathematics should have permeated the work of the great architects of those days. I welcome in particular, the contributions from some of the departmental heads of Government, notably the articles on Road Transport, the Railways of Madras and Libraries in Madras. Our thanks are due to the various contributors who have made it possible to present to the Conference a souvenir of interest and value worthy of the occasion.

A. L. MUDALIAR

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C. V. Raman

# THE INDIAN MATHEMATICAL SOCIETY

BY

S. Mahadevan, M.A., L.T.,
*Secretary, Indian Mathematical Society*

Founded in 1907, the Indian Mathematical Society completes 42 years and at this juncture when the sixteenth biennial conference is being held at Madras, it will be out of place to look back and review briefly the growth of the Society and the part it has played in the development of mathematical research in India.

Time was when mathematicians in India carried out the researches in solitude unaware of the work of others that were interested in their own field. In the early years of this century, the need was widely felt for an association that will bring together mathematicians from different parts of the country for collating their ideas and for conducting co-ordinated research in different branches of mathematics. At this stage, the late Mr. V. Ramaswamy Iyer who was then the Deputy Collector at Gooty addressed a letter early in 1907 to a few friends on the need for joining together in a club, subscribing for higher mathematical books and journals and thus widen the sphere of their knowledge. About twenty members responded to the letter and with them the 'Analytic Club' was formed in April 1907 which later developed to be the nucleus of the Indian Mathematical Society.

From the very outset the society was conceived of on an All-India basis. The founder spared no pains to promote the interest of the society—issuing circulars, framing a suitable constitution and creating a library. The headquarters of the Society is located in the Fergussion College, Poona and Prof. R. P. Paranjpye, the then principal of the college was made the first honorary member and he also undertook to-act as the librarian of the Society.

During the first two years, the society was issuing reports every two months and in 1909 'the Journal of the Indian Mathematical Society' was started under the distinguished editorship of the late Prof. M. T. Narayaniengar. A few years later when the journal began to appear regularly, members became aware of the progress made in different spheres of work and were eager to meet and discuss problems of common interest. As in any other branch of science, they felt that this most exact of all sciences too, would benefit a great deal through discussion and clarification of ideas on the various intriguing questions, which would otherwise remain unanswered. This led to the idea of holding periodical

conferences. After a futile attempt in 1913, the question was taken up again in 1916 when the late Mr. P. V. Seshu Iyer, who was then the assistant secretary offered to shoulder the responsibility of arranging a conference at Madras. To him goes the credit of convening the first conference of the Indian Mathematical Society which was held in December 1916 at Madras. There was a good gathering of members, and the conference was opened amidst great enthusiasm by His Excellency Lord Pentland, the then Governer of Madras. Though the total number of papers read at the conference were only eleven, this forms an important land mark in the progress of the society.

The popularity of the first conference was such that the managing committee decided to hold conferences every two years. Accordingly such gatherings were held in Bombay, Nagpur, Lahore, Bangalore, Aligarh, Lucknow, Delhi, Poona, Trivandrum, Hyderabad, Annamalainagar and Waltair. After a lapse of more than three decades, the University of Madras, has once more the honour of playing the host, not only to mathematicians from all parts of India, but to a few distinguished votaries of the subject from abroad.

Since its first appearance in 1909, the journal has made, rapid strides and has now become a well-established organ of the Society. It is a mater of pride to the Society that the earliest contributions of the mathematical genius, Srinivasa Ramanujan, were published in the journal. His first paper on 'Some properties of Bernoulli's numbers" created quite a stir in mathematical circles. The silver jubilee of the journal was celebrated in 1932 at Poona and it was decided to expand the activities of the society by bifurcating the journal and issuing two types of periodicals, the first retaining the old name and publishing papers of original research and the second, 'The Mathematics Student,' catering to the needs of the students and teachers in colleges, and research workers. It strives to kindle enthusiasm in the minds of students, to incite teachers to an improvement in teaching methods and to help research workers by reviewing articles on newly developed branches of the subject and by drawing attention to unsolved problems.

The library of the Society at Poona has, besides a fine collection of books, both back numbers and current volumes of a large number of Indian and foreign periodicals. Members have all an easy access to these books and periodicals and there is a system by which current periodicals are put in circulation among those who wish to consult them. Unfortunately, the limited funds at the disposal of the society, have rather cramped the equipment of the library.

The Society derives its income from the subscriptions paid by members, donations from Universities and of late from the Rockfeller Foundation.

The present list of members of the Society cover distinguished mathematicians, not only from all parts of India, but from different countries of the world. The periodicals published by the Society, have also a world-wide circulation. In this period of over four decades, the Society has been able to expand its activities steadily, striving throughout for the progress of mathematical research in India. The future of the Society is closely linked up to the progress of research in the country . With the attainment of political freedom and the realisation of the importance of scientific research for the progress of the country, this Society which has the avowed objective of promoting research in the basic science, mathematics, is bound to have a promising future.

# PRESIDENTS OF THE INDIAN MATHEMATICAL SOCIETY

BY

A. Narasinga Rao, M.A., D.Sc.,
*Gandhian Professor of Mathematical Physics, Andhra University*

The affairs of the Indian Mathematical Society are managed according to its constitution by a committee consisting of a President, two Secretaries, a Treasurer and seven members besides a permanent librarian and is reconstituted every two years. While the President and Secretaries are eligible for re-election among the other members two with the longest standing must retire at every reconstitution. Ever since its inception in 1907, the society had so far a succession of fourteen Presidents, all men of eminence in their own walks of life. Nine among them were distinguished Professors of Mathematics and the remaining five were administrators, although two of them began their careers as Professors.

The first President of the Society was the late Mr. B. Hanumantha Rao, one of the earliest graduates of the University of Madras. He was the Professor of Mathematics at the Kumbakonam college for some years and later at the Engineering College, Guindy. After his retirement from government service he lived in Mylapore for several years. He was very regular and punctual, never late by a minute or extending his class beyond the hour, and had the reputation of being a strict disciplinarian. However those who succeeded in penetrating the severe crust found in him, a warm hearted friend ready to advise and help from his vast experience of men and things. He was the author of a book on Geometry.

He was succeeded in 1912 by Prof. R. N. Apte a brilliant student of Elphinstone College, Bombay who was a Professor of Mathematics in the Bombay Educational Service and was for a large number of years connected with the Rajaram College, Kolhapur as Professor and later the Principal of that institution. Prof. Apte is an LL.B. and had the rare distinction of serving as a judge of the State courts in addition to his appointment as Professor of Mathematics. Prof. Apte is, still in our midst, and is having a retired life at Kolhapur.

The third President of the Society (1915) was Prof. E. W. Middlemast, a Cambridge Wrangler and a member of the Indian Educational Service, and was Professor in the Presidency College, Madras and later its Principal. I had the privilege of being his student and well remember his methodical way of teaching with the lines on the blackboard neat and strictly parallel, his clear explanations, and his equipoise. When I was an undergraduate I was interested in finding a curve similar

His Excellency Maharajah of Bhavnagar
Governor of Madras
Patron

Dr. Sir A. Lakshmanaswami Mudaliar
Chairman of the Reception Committee

to its evolute and took to him the functional equation $f'(x) = a.f(x+b)$ where $a$, and $b$ are constants, for getting a general solution, he brought me an interesting and formal solution the next day as an infinite series involving exponential functions though he did not deal with the question of convergence.

Prof. Middlemast was succeeded by the late Dewan Bahadur R. Ramachandra Rao, an administrator of great ability and independence, who rose to the level of the Secretary for Education with the Government of Madras. A clear thinker with a reputation for severity and matter of factness, he never minced words, and when a group of assistant professors and lecturers waited on a deputation for an improvement of salaries of teachers in the subordinate services of the Government, he told them that under the conditions then prevailing nothing could be done, and that they should find happiness in teaching and give up the pursuit of pleasure through money, or change over to more lucrative jobs and forego the pleasure of teaching. He did pioneer work in the development of village Panchayats and his administration was marked by a warm sympathy for the people in the villages. The following advice which he gave Sir S. V. Ramamurthy who was then young and later distinguished himself as a keen mathematician and an able administrator, is characteristic of the man. "Never ask for instructions. If there are rules that deal with a situation, keep within them. If there are no rules, exercise your discretion and make your own decision; do not ask for instructions." In this connection Sir Ramamurty adds, "This advice is in consonance with the spirit of mathematics, where given the data all further propositions thereon, or deductions derived therefrom, are reached by reason and not by authority. This makes both for quality and strength in judgment and action. Mr. Ramachandra Rao is one of the examples of a mathematician successful in administration because he was a mathematician."

Sri Ramachandra Rao's name will always be remembered with affection and gratitude for the prominent role he played in helping Srinivasa Ramanujan during the days of his struggle against poverty and neglect, a vivid account of which is given in the introduction to the book 'Collected Papers of Srinivasa Ramanujan" by Prof. Hardy.

Prof. A. C. L. Wilkinson (1917-1921) was elected next as the president of the Society who was another member of the Indian Educational Service and he came to India in 1899 as Professor of Mathematics, Elphinstone College, Bombay. He was the second wrangler of 1898, and had passed both parts with first class honours. He served later in the Deccan College, Poona and was also the Principal of the college. Prof. Wilkinson was a keen mathematician and contributed papers to the Journal of the Society. He presided over the first conference of the Society held at Madras in December 1916.

Prof. Wilkinson was succeeded by the late Mr. H. Balakram, I.C.S., another administrator who took a keen interest in mathematics and was a pillar of strength to the Society. He was the 4th wrangler of 1900, and served in the Accountant General's Office, Bombay, and finally in the judicial department where for sometime he acted as High Court Judge. At the time of his death in 1929 he was the Secretary to the Government Legal Department. Shortly before his death, Mr. Balakram was engaged on compiling a list of numbers which could be expressed as the sum of two cubes in more than one way. He also made a munificent donation for the Society's library.

The next president (1926-30) was no less a person than the Founder of the Society, Mr. V. Ramaswamy Iyer. After taking the Master's degree he served as lecturer in the Central College, Bangalore and Mysore Maharaja's College for brief periods and was taken later into the Provincial Civil Service and became a Deputy Collector. His devotion to mathematics was so intense that he sometimes neglected his office duties and this to some extent affected his promotions. He was a regular contributor to the Journal on a variety of topics, amongst which geometrical ones predominated. Ramaswami Iyer used elementary methods with telling effect and had the master's secret of leading his readers on through intricate mazes without their ever feeling that the journey was other than simple and straight. He has left behind him 3 quarto and a dozen folio notebooks which have been partly published and will still repay study. He had an inspiring and magnetic personality and was a wonderful organizer. A detailed account of his mathematical work in addition to some biographical notes have been published in "The Mathematics Student."

Mr. Ramaswami Iyer was succeeded by Mr. M. T. Naraniengar who was the professor of Mathematics at the Central College, Bangalore. He was the President from 1930 to 1932 and was also the founder and first editor of the 'Journal of the Indian Mathematical Society'. The earlier issues of the Journal show how ready he was to step into the gap with telling articles when papers were scarce. A simple, amiable and well read man of orthodox habits, he had a gentle and retiring personality and was universally loved and respected. In grateful appreciation of two decades of editorship of the Journal an address was presented to him by the members of the Society when they met at Bombay for the Silver Jubilee celebrations.

Rao Bahadur P. V. Seshu Iyer, who was the president from 1932 to 1934, was a joint secretary of the Society for several years and one of the most enthusiastic of those who helped in the growth and stabilisation of the Society. He was a good organizer, and arranged the first conference of the Society at Madras. He had the gift of influencing people easily, and used his powers for helping those who deserved encouragement, the most

noteworthy of them being Ramanujan, himself who was then an unknown young man quietly filling his note books with strange results. At a time when rigour was almost unknown, he insisted on correct proofs and, late in life, he learnt French to follow fully the presentation given in French treatises. He was ever a student learning new subjects and eagerly presenting them to others. I will remember an illuminating analogy he used to explain the difference between Riemann and Lebesque integrations. The former, he compared with the harvesting of paddy, where handfuls are picked up from the grain that lie in a small ground area, while the latter is compared with that of selecting candidates for employment; a first selection of those who reach the highest level of attainment wherever they may be located and then a second selection at the next level for the remaining posts.

Mr. H. G. Gharpurey, I.C.S., (1934-1936) who succeeded thereafter was another whose keen interest in Mathematics raised him to the Presidential Chair. After retirement from the Civil Service he worked as a member of the managing committee before he became President of the Society.

Dr. R. P. Paranjpye (1936-1940) was the next president and was the first honorary member of the Society. His success as senior wrangler in 1899, along with Birtwistle, was hailed in India with unprecedented enthusiasm and provided an inspiration for the younger generation. After serving for several years as Professor of Mathematics and Principal of Fergusson College, Poona, Dr. Paranjpye entered politics as a Liberal and occupied various important posts including the Ministry of Education in the Bombay Cabinet, and membership of the India Council. The Society met at Lucknow while he was Vice-Chancellor of the Lucknow University. After serving as a trade commissioner in Australia, he is recenty back in India. An authority on all educational matters he maintains the fine traditions of scholarship, efficiency and sacrifice inculcated by the great master Gopalakrishna Gokhale.

With Dr. R. Vaidyanathaswamy as President (1940-'42) we come to the modern phase in the progress of the Society. In the meantime, the tone of the Journal had considerably improved. Thanks to the young men and women, many of them pupils of Dr. Vaidyanathaswamy, who were receiving training in the University of Madras, there was less of geometry and modern topics commenced to attract the attention of mathematical wishers. Dr. Vaidyanathaswamy studied in the Presidency College, Madras and worked later with Prof. Turnbull at St. Andrews and for some time with Prof. H. F. Baker in Cambridge. His contributions to Mathematics cover a variety of topics such as invariant theory, geometry, theory of multiplicative functions and topology. On the last of these subjects he recently published an important treatise.

Prof. F. W. Levi, (1942-'46) was the thirteenth president of the Society who brought with him a European reputation as a mathematician and as the author of a treatise on Geometrical Configurations, when he took up the appointment as Hardinge Professor of Mathematics in the Calcutta University. A number of young workers were initiated into modern mathematics under his guidance. Prof. Levi has published books on Modern Algebra, on Finite Geometrical systems and on the fundamentals of Analysis after coming over to India and is actively at work on Group theory and allied topics in the Tata institute of Fundamental research at Bombay.

Dr. M. R. Siddiqi who succeeded Prof. Levi (1947-'49) was a student of Heisenberg and the author of a treatise on Quantum Mechanics. He made important contributions to the solution of non-linear partial differential equations and has also published a booklet on the subject in the Lucknow University studies. He was a professor of Mathematics at the Osmania University and was later Director of Research in the same University.

The above account of the presidents of the Society is not exhaustive but is intended mainly to present a rough picture of the various distinguished men that the Society had the fortune of having them as its Presidents. The high traditions that have so far been zealously maintained will, I am sure, act as the guiding star for the future progress of the Society.

Sir C. P. Ramaswami Aiyar
Opener of the Exhibition

INDIAN MATHEMATICAL CONFERENCE, MADRAS

Dr. A. Narasinga Rao, M.A., D.Sc.
President

# THE PRESIDENT ELECT : A BIOGRAPHICAL NOTE

BY

G. A. Srinivasan, M.A., L.T.,
*Professor of Mathematics, Presidency College.*

The Indian Mathematical Society has been honouring the distinguished mathematicians in the country by electing them as the presidents for the biennial conferences. For this Sixteenth Conference, the Society has elected Dr. A. Narasinga Rao, M.A., D.Sc., who is at present the Gandhian Professor of Mathematical Physics in the Andhra University, Waltair.

Born at Kumbakonam on the 8th December 1893, Dr. Narasinga Rao had a brilliant high school career and entered the Madras Christian College, in 1910. He came out third in order of merit in the Intermediate Examination of March 1912. He took up the Honours course in Mathematics in the Presidency College, Madras. During these years, along with his class-mate Dr. R. Vaidyanathaswamy and his senior, Prof. K. Ananda Rao, they started the Presidency College Mathematics Association in 1913, and were very enthusiastic in promoting its activities.

Immediately after taking the honours degree in Mathematics with a first class, Dr. Narasinga Rao joined the staff of the Madras Christian College and was there for a period of six years. He then entered Government services in 1921 and for most of the time till 1928, served as Assistant Professor of Mathematics in the Presidency College. He was given a research fellowship by the University of Madras in 1928, and was awarded the degree of Doctor of Science, for his thesis on "Studies in Circle Geometry."

When the Annamalai University was founded in 1929, Dr. Narasinga Rao was appointed as Professor of Mathematics, where he stayed for a period of seventeen years. In 1946, he was offered the chair of the Gandhian Professor of Mathematical Physics of the Andhra University, Waltair.

After entering the Annamalai University, during these twenty years, Dr. Narasinga Rao has trained a large number of young mathematicians, many of whom are holding distinguished positions. He made valuable contributions on a variety of topics like geometry and topology, influencing a large number of young students who are continuing researches in these branches. Special mention must be made of the long and meritorious service he has rendered to the Indian Mathematical Society for over two decades in various capacities as assistant secretary, as treasurer and as the editor of 'the Mathematics Student', ever since its

inception. A significant index of his abiding interest in the advancement of Mathematical research in India, is the gold medal he instituted in his name in 1945.

Dr. Narasinga Rao is a Fellow of the Indian Academy of Sciences, member of the Aeronautical Society of India and a Collaborateur of Revue Semestrielle des publications mathematiques, Amsterdam. With his ample experience and a distinguished record as a Mathematician, there is no doubt that Dr. Narasinga Rao will be able to guide and promote the progress of the Society during the period of his presidentiship.

# MATHEMATICS IN ADMINISTRATION

BY

SIR S. V. RAMAMURTY, C.I.E., I.C.S.

Administration is the practical implementation of political, economic and social policy. Policy is a structure of ideas and is derived from vision. Practice is a structure of facts and is the result of action. From policy to practice, from vision to action, the passage is from the region of mind to the region of matter. The idealist who regards reality as a countinuum of ideas has to give recognition to material observers and thinkers as the boundaries of ideas. The realist who regards the universe as a countinuum of facts or events has to recognise the ideas of an observer as the connecting links. Reality is thus a string of mind and matter, continually alternating. If the string begins at mind, it ends in mind. If it begins at matter it ends in matter. Whether the world is mind or matter depends on the point of vision or perception. It is permissible to philosophers like Bertrand Russell to postulate that the string of mind and matter is made neither of mind nor of matter but of a neutral stuff, which is both and is neither. Mathematics in which mind and matter meet man must be viewed as the laws of being of this neutral and common stuff.

The administrator needs to be both an idealist and a realist and not either exclusively. Without the laying down of a policy, he cannot implement it. But he cannot make a policy without a study of facts. The path of an administrator lies from facts to ideas and thence to facts again. While the philosopher forms ideas which he tests on facts and retires to ideas again, the administrator studies facts from which he forms plans and thence moves to facts again. The administrator thus differs from a philosopher in his stand point but not in his flow of life. This makes them different in method but one in spirit.

The world is one because it has one self. It is many because the one self multiplies itself into structures of number arithmetically, geometrically and in a complex variety of functions. The administrator as the pivot of understanding and of action is located at his one self. But he has to be *en rapport* with the many in the world by finding a quantitative expression of himself. Thus the quality of the self seeks identity with the quality of the world through a quantitative adjustment. This quantitative adjustment takes place either by a synthesis of units or an analysis of a function. The identity between Atman and Brahman, between the one self and one world is through number, that is to say, is a mathematical relation. It has been truly recognised in Hindu Philosophy that Brahman is both *anu-rupa* and *sankhya-rupa*. It is a synthesis of

atoms through the agency of number. Brahman analysed gives atman, as atman synthesised in its many functional aspects yields Brahman.

Administration is one facet of this mathematical structure of life. Administration is concerned primarily with human beings. It selects for its study the facts that bear on the wealth and welfare of human beings. Like an architect that builds a structure of bricks and not content with his structure, breaks it down into bricks and builds again, a statesman takes the facts of life, the needs of man, their capacities, their objectives, the resources of nature, their potentialities and their tendencies and not being content with the countinuum of people's life as he finds it, he makes a new plan and sets about the implementation of the plan. The totality of men and things that he finds and that he seeks to erect are the same. But he seeks to bring out a new reorientation of men and things. In a world of specialised functioning, a statesman makes plans and an administrator implements them. But obviously the process of reorienting life has greater cogency if he who makes plans also implements them.

The philosopher who makes ideas, the statesman who groups them for the purpose of realisation and the administrator who realises them are all one in spirit and they differ only in their immediate methods. In the long run, method becomes unified in spirit as immediately spirit melts into method. The passage from spirit to method is a passage from the centre to the circumference of life. It is a passage from quality to quantity. Through mathematics, spirit extends into method, ideas become facts, plans evolve into practice.

I have been asked sometimes how mathematics has helped me in administration. An administrator has to deal with many problems. Each problem needs to be analysed into its basic elements. If one applies his mind in a clear and critical way, one finds the basic elements of a problem to be few. Take any field on the ground. It may have crooked boundaries. It may have mounds and gullies. But a mathematician analyses it into three basic dimensions and every point on the field can be expressed in terms of three variables. Having got a plan of the field, you can remould it as you like. Without changing its area, you can rectify its boundaries to gain the practical objectives in view. You can change its contours similarly. Every problem is a kind of jig-saw puzzle. The pieces are all there but you find that they are not together allright. You have to analyse the pieces and see some line along which you may rearrange them to get a desired result. Thus the solution of an ad-change its contours similarly. Every problem is a kind of jig-saw puzzle. The pieces are all there but you find that they are not together allright. You have to analyse the pieces and see some line along which you may rearrange them to get a desired result. Thus the solution of an administrative problem lies first through analysis and then through a synthesis. If the administrator is also responsible for planning he has first

to synthesise facts and having got a synthetic plan, reanalyse it into facts acceptable to people. An administrator who takes up a file—he deals with many each day—can work economically and effectively, if he first analyses the problem in his file and then makes a synthesis through his solution. This is the spirit of mathematics. The methods of mathematics are as many as its branches. Some of these specialised methods are needed to deal with special subjects of administratio bearing on economic and social development but the basic method of mathematics is to find atomic elements of a problem and re-string them through number for a solution. Both the spirit and the method of mathematics have relevance and value in administration.

There is no line of academic discipline which fits a man for administration better than the basic training of mathematics. Such success as I have had as an administrator, I ascribe to the mathematical training that it has been my good fortune to receive.

# RECENT RESEARCHES IN PURE MATHEMATICS FROM MADRAS

(CONTRIBUTED)

Mathematical researches in South India received considerable fillip with the formation of the Indian Mathematical Society in 1907 under the inspiration of Mr. V. Ramaswamy Iyer and a number of other enthusiasts. Two years later, in 1909, the Journal of the Indian Mathematical Society was started and the early issues of this journal contained regular articles mostly in the field of elementary geometry with particular reference to various special points, lines and circles in the geometry of the triangle. These published papers provide even to-day profitable reading for research workers who are conducting researches in these branches. During the years 1913-1918 the journal published the early papers of Srinivasa Ramanujam. Although some of his problems and ideas did receive attention in the later mathematical researches from South India his main work has not been fully utilised.

Rao Bahadur K. Ananda Rao who worked as the Professor of Pure Mathematics in Presidency College for nearly three decades and retired recently is one of the topmost mathematicians from South who made original contributions to mathematical researches. His towering personality inspired a large number of young men who in their turn made valuable researches in various branches of Mathematics in recent years.

Prof. Ananda Rao's researches relate to the theory of convergence and summability of series. His early work, a part of which formed the Smith's Prize Thesis of the Cambridge University in 1918, deals with generalisations, using Riesz's method of summability by typical means, of some of Hardy and Littlewood's Tauberian Theorems and their application to convergence and summability of Dirichlet's Series. He also published an important paper on Lambert Series in which he defined "Lambert Summability (L)" as

$\sum a_n$ is summable (L) to $s$ if

$$f(y) = \sum a_n \frac{nye^{-ny}}{1 - e^{-ny}} \to s \text{ as } y \to 0.$$

There are a number of other interesting results on this method of summation published by him.

His researches cover the behaviour of the Elliptic Theta functions $\theta_3(0, t)$ given by

$$\theta_3(0, t) = 1 + 2q + 2q^4 + 2q^9 + \ldots\ldots; q = e^{\pi i t}; t = x + iy$$

This series is convergent and represents an analytic function in the half plane $y > 0$. The behaviour of this and the other Theta functions when

$t$ tends to a real number $\xi$ along a straight line $x = \xi$ is considered by Hardy and Littlewood. In addition Prof. Ananda Rao studied fully the behaviour of the series when $\xi$ is a quadratic surd and proved that the periodicity of the continued fraction for $\xi$ is reflected in the behaviour of the Theta functions and that this leads to formulae which involve actual limits. There is another interesting paper of his on Riemann's Zeta function, wherein the Weirstrassian product for $(s-1)\ G\ (s)$ is obtained without using Hadamard's Theory of integral functions.

Among the students that were influenced by Prof. Ananda Rao's work was Dr. T. Vijayaraghavan who is now the Professor of Mathematics, Andhra University. He worked under Prof. G. H. Hardy at Cambridge and proved certain Tauberian Theorems under very general conditions. A mention may be made of the following results.

Let $s_n = a_1 + a_2 + \ldots\ldots + a_n$, and suppose
$Lim\ (s_m - s_n) \geqslant 0$

where $m > n$ and $m$ and $n \to \infty$ such that $\frac{m}{n} \to 1$,

and also suppose $\underset{x \to 1-0}{\text{Lim}} \sum_{n=0}^{\infty} a_n x^n = 0$.

Then $\sum a_n = 0$.

The ideas underlying this and other allied papers have been used by later writers. Dr. Vijayaraghavan also disproved a well known conjecture of Borel on the rate of increase of real continuous solutions of algebraic differential equations by showing that for any continuous function $\phi(x)$ there is a polynomial differential equation of second order possessing a continuous solution of higher order than $\phi(x)$. There are a large number of papers published by him on a variety of subjects such as Diophantine approximations, singularities of Analytic Functions, and "On the fractional parts of a number."

The work on Tauberian theorems has been continued by a number of research workers of whom a mention can be made of Dr. V. Ganapathy Iyer, Dr. V. Ramaswamy, Mr. C. T. Rajagopal and Dr. S. Meenakshisundaram, the first three of whom were students of Prof. Ananda Rao.

Dr. Ganapathy Iyer has published some papers dealing with Tauberian theorems and a large number on the theory of functions dealing with a variety of topics including analytic functions with assigned values at a given set of points, and problems related to derivatives of infinite order. Considerable work has been done by Mr. C. T. Rajagopal on the convergence and summability of series. He unified and extended the classical theory of convergence of sequences and series due to Pringsheim, Cesaro, Hardy and others. In two other papers he discusses the relation between the limits of oscillation of a function and its Riesz

Integral means either improving or extending theorems of Fekete, Winn, Karamata, and Meenakshisundaram. He has also supplemented the work of Dr. Ganapathy Iyer on periodical integral and Meromorphic Functions. Dr. Ramaswamy, Reader in Mathematics, Andhra University, who worked sometime under Hardy and Littlewood has, besides giving new and interesting proofs of some properties of the 'Zeta function' made important contributions to the subject of Tauberian theorems particularly in the estimates of oscillations of sequences.

Dr. S. Meenakshisundaram started his work with the application of topological methods to solving non-linear partial differential equations of the parabolic type. This led him to the problem of expansion in Eigen functions (of the membrane problems). Just as Cesaro summability plays an important role in the theory of Fourier Series, summability by typical means—the typical means being the Eigen values—plays an important part in the theory of Eigen function expansions. His results are published in a series of papers in the journals of the Indian and London Mathematical Societies during the years 1940-'45. The theory of expansion in Eigen functions as developed by him is not complete and opens up new lines of research. Any further work on this subject depends on a deeper knowledge of the properties of Eigen functions. His recent contribution deals with the Dirichlet's series $\sum \frac{\omega_n(x)\,\omega_n(y)}{\lambda_n{}^s}$ where $\omega_n(x)$, $\omega_n(y)$ are Eigen functions, $\lambda_n$ the corresponding Eigen values and $s$ is a complex number, which is a generalisation of Epstein's Zeta function, and behaves just like it with regard to analytic continuation. The results in this direction are to be found in two papers he published along with Plieyel in the Canadian Journal of Mathematics.

Another student of Prof. Ananda Rao, Dr. K. Chandrasekaran, in addition to his work on a new type of summability—the Bessel sumability—has made important contributions to the theory of Multiple Fourier Series. As a special case of Eigen value expansion, this theory takes the form of the so-called spherical summation of multiple Fourier Series, first suggested by Bochner and later studied by Dr. Chandrasekaran in detail. He introduced in it the reciprocal relationship between the function and its Fourier series and has since been working on its applications to Lattice point problems and allied topics. Some of his recent works on these subjects are in collaboration with Bochner, and Meenakshisundaram.

The creation of a separate department of Mathematics in the University of Madras in 1927, acted naturally as an active centre of Mathematical research in South India. Under the able supervision and guidance of Dr. R. Vaidyanathaswamy, Professor of Mathematics, a number of workers are being trained and this has resulted in a large output of research in different branches of Mathematics.

Geometry, both in the direction of elementary geometry and algebraic geometry, has been a favourite subject in Madras and has received a fair representation in the output of work of the department of Mathematics. Even the early work of Dr. Vaidyanathaswamy was on algebraic and invariant theoretic geometry and geometry of apolarity. His later work was on pedal correspondence and mixed determinants and his thesis for the doctorate degree dealt with the rank of the double binary form and binary geometry of the norm curve. The subsequent works of his deal with Desmic transformations, cubic transformations connected with a desmic system and its application to circle geometry and an extension of Poncelot's theorem. His work on the norm curve was further extended by Dr. B. Ramamoorthy in his thesis for the doctorate degree. Considerable work has also been done in projective geometry by students of the research department during the last few years.

Important contributions to circle and allied geometries have been made by Dr. A. Narasinga Rao, the present Professor of Mathematical Physics of the Andhra University. He introduced the concept of a $n$-dimensional turbine and thus obtained a "Turbine Geometry" as an extension of the geometries of Mobius, Laguerre and Lie in which the conformal and equilong patterns commingle into a single entity taking the characters of both. He has also studied the topology of the manifold of line elements, both oriented and non-oriented in the inversive plane. In addition, he published a number of other papers dealing with circle geometry, the Miquel-Clifford configuration and a classification of quadratics of revolution through a given conic. He has also published a number of papers on collegiate Mathematics in the "Mathematics Student" of which he is the editor. Under the influence and guidance of Dr. Narasinga Rao work in recent years has been directed on a line complex connected with a quadric in $n$-dimensions, on the pedal contact systems of circles and on chain Theorems in Geometry. Another branch of research under his supervision has been on Differential Geometry of path spaces.

Considerable work has been done, following Dr. Vaidyanathaswamy's long memoir in which a new algarithm on multiplicative functions was put forward based on the concepts of linear and rational multiplicative functions. The study has been continued by Dr. P. Kesava Menon who considered various special types of multiplicative functions. He also published several papers on theory of numbers including one in which he considered the application of certain identities of elliptic theta functions to the theory of numbers. Researches in the department of Mathematics in the university cover also Ramanujam's Trigonometrical functions, $C_m(n)$ has been studied as a multiplicative function in the arguments $m$ and $n$, and has been shown to be identical with Von-Sternuck's function defined as the excess of the number of partitions of $n$ into

parts modulo $m$ into an even number of parts over the number of partitions into an odd number of parts, the parts being taken from the set of numbers less than and prime to $n$. The general problem of partitions of a number $n$ into parts mod $m$, the parts being chosen from a given set of numbers is also studied in recent years. Equally important is the work dealing with the application of the group of residue classes to arithmetic and the discovery of a special class of numbers and the application of modular functions to properties of numbers.

Dr. S. S. Pillai has specialised in some problems in the theory of numbers for which he had a special aptitude from his student days. On the whole he published a large number of papers. The original form of Waring's problem has been almost completely solved independently by Pillai and Dickson. Though the intricate problem of $G(k)$ remains unsolved, they have determined the exact value of $g(k)$. For all $k$ greater than or equal to 7, barring a few exceptional cases that may be non-existent. He has also determined the exact value of $g(6)$. He studied the properties of numbers which are analogous to them and a generalisation of the highly composite numbers of Ramanujam. Dr. Pillai in addition has made several important contributions on various topics in the theory of numbers including those on "Lattice points in a right angled triangle", the equation $\phi(x) = n$ and Diophantine topics like the equation $a^x - b^y = c$. One of Pillai's results on the above equation has been used by Prof. Hardy in connection with a problem of Ramanujam. On this branch important contributions have been made by Dr. Sambasiva Rao who studied certain topics in the theory of numbers besides publishing papers on Waring's problem and allied subjects. Among his other work may be mentioned papers on "Vinogradow numbers", "On the representation of a number as a sum of the $k$th power of a prime and $l$th power of a free integer" wherein he generalised a theorem of Pillai on the same topic. In addition some contributions have been made by workers in the Andhra University on problems in difference forms, and Jacobi's multipliers.

Though modern algebra has attracted the attention of research workers there has not been equally important contributions from South India in this branch. Dr. Vaidyanathaswamy published papers on the Algebra of classes into which the residues of a number modulo $n$ and integer $m$ can be divided, and on quadratic reciprocity theorems of polynomials modulo $p$. Following this Dr. T. Venkatarayudu studies the ideal theory of the Abelian group algebra. His later studies on group characters have been incorporated in the book "Group Theory and its application to Physics" published recently in collaboration with Prof. S. Bhagavantham.

During the last decade research work in modern subjects like Topology, partially ordered sets, function spaces and symbolic logic is being

pursued in the Department of Mathematics in the University of Madras under the guidance of Dr. Vaidyanathaswamy, who in addition to contributing some papers on partially ordered sets has published the valuable "Treatise on set Topology" in 1947. Other work by students of University department include the last residue class in the distributive lattice, a criticism and improvement of McVeil's theory of extension of partially ordered sets, a characterisation of the Maximal Hausdorff spaces, topology of linearly ordered spaces, and on a theory of fractional powers of linear operators in Banach spaces. Dr. Ganapathi Iyer has also worked in this direction, publishing a number of papers on the topology of linear spaces.

The subject of symbolic logic has also attracted attention of research workers from Madras. Dr. Vaidyanathaswamy, who is again responsible for initiating research in this direction, has published a paper on Disjunction Institutionistic Logic. Work in this branch has been continued on Finite Boolean Algebras, ideal theory of Boolian algebra, and Brouwver's theory of linear order.

Considerable amount of work is now in progress in the University department by a number of enthusiastic young workers in different branches. It is not possible in such a review of current researches to give adequate importance to research by various workers.. But, as far as possible, attempt is made here to outline general branches of work that have attracted the attention of mathematical researchers from South India.

In addition to the researches in Pure Mathematics, considerable work has also been done in statistics and various branches of Applied Mathematics but this article limits itself only to the research work in Pure Mathematics.

# SRINIVASA RAMANUJAN

(1887-1920)

The pursuit of knowledge for its own sake has not been a new thing in this country, and though the largest share of such activity had been devoted to religion and philosophy as being the bedrocks of human welfare, at less profound subjects like Mathematics and Astronomy were not without their votaries. The name of Ramanujan takes us back to Bhramagupta, Bhaskara and Aryabhatta, who in their own way made important contributions to mathematical science. The appearance of genius in any field of thought is always a difficult thing to explain and especially it is so in the case of Ramanujan who without the aid of the orthodox systems of instruction, shines forth with unique originality and power. The emergence of such phenomenal genius, though occasional, tempts one to believe that the theory of persistence of a general racial memory, is not altogether without foundation.

The early life of Ramanujan, like many other mathematicians, is overshadowed by a continuous struggle with poverty till his remarkable researches commenced receiving recognition after the publication of his first substantial paper in the journal of the Indian Mathematical Society in 1911. Born in Erode on the 22nd December, 1887, Ramanujan belongs to a poor and humble family and had later the usual high school education from the age of seven to sixteen. He then entered the Government College, Kumbakonam, where he won a scholarship. In no other science, as in Mathematics, it is so easy for a student's interest to be aroused at this early age when he studied Trigonometry and found for himself results given in Part II Loney's Trigonometry. This unaided discovery of some of the famous theorems of Mathematical Analysis, while still at school, was only a prelude to the strikingly original contributions he made at a later date.

At the age of sixteen he borrowed an old book of Carr's "A Synopsis of Elementary Results in Pure and Applied Mathematics" which combined sections on Algebra, Trigonometry, Calculus and Analytical Geometry emphasising particularly the formal side of Integral Calculus. It was this book that really awakened Ramanujan's genius and it secured such a grip on him that he used to spend all his time at the college, upon mathematics including even the lecture periods in other subjects. His neglect of college work other than mathematics led to disaster. He lost his scholarship, left college, ran away from his home and after another futile attempt to continue the collegiate education, joined the Pachiappa's College, Madras, in 1906. Even here he was not successful and was forced to return to his native town on account of sickness. Later, in

Srinivasa Ramanujan (1887-1920)

1907, he appeared for the F.A. examination as a private student and failed.

From 1907 to 1912 Ramanujan was adrift in the world without any definite occupation except his mathematics and the fact that he was able to tide over this period was largely due to the generosity of several of Ramanujan's friends, who, clearly realising his extraordinary orginality, helped him to devote himself to his mathematical studies. His marriage in 1909 made it imperative for him to find a regular employment and in 1912 he became a clerk in the office of the Port Trust, Madras for a paltry salary of Rs. 30 per mensem. After the publication of his first paper, he began to secure some recognition in India. In January 1913 Ramanujan entered into correspondence with Professor Hardy sending him the enunciation of great many results he had found, many of them strikingly original and thoroughly intriguing, others well known and some false and yet not without considerable interest and significance. Events had begun by this time to take a more favourable turn in India. The University of Madras gave him a scholarship of £ 250/- a year, tenable in England, adequate for a married Indian. He reached Cambridge in April 1914, and he had three years of uninterrupted activity and continuous contact with Hardy. He fell ill in 1917 and never fully recovered. He died on the 26th April, 1920, at Madras shortly after his election to a Fellowship at Trinity College. He was the first Indian to be awarded either honour. During the short span of three decades of life, the most striking feature was his unaffected simplicity, which endeared him to all who had the privilege of knowing him. All the honours that were showered on him, including his election to a fellowship of the Royal Society, did not affect his natural simplicity.

The correspondence Ramanujan had with Prof. Hardy gives a clear indication of the peculiarity of his mathematical thought which had an individuality of its own. His letters contained a collection of a large number of mathematical Formulae involving Infinite Series, Integrals, Continued Fractions and also results in the Theory of Numbers. His familiarity with Elliptic Functions, which has to play an important part in his later Researches, are in evidence in this collection of Formulae; and his bold conjecture regarding the dominant terms in some of the asymptotic formulae in the Analytic Theory of Numbers are really wonderful. His best work was done chiefly on subjects as the Theory of Elliptic and Modular Functions and the Theory of Numbers.

The limitations of his knowledge were as startling as its profundity. He worked on Modular Equations and Theorems of complex multiplication to orders unheard of, without having an idea of the Doubly Periodic Functions or of Cauchy's Theorem and had indeed the vaguest idea of what a function of complex variable was. All his results were obtained by the process of mingled argument, intuition and induction of which he was entirely unable to give any coherent account.

Under the genial influence of Prof. Hardy he acquired in a couple of years a fair knowledge of the Theory of Functions; and with this, his writings began to take distinctly fruitful directions. His paper on "Highly Composite Numbers" is entirely new and the skill with which he investigates their properties by purely elementary methods is really remarkable. His papers on certain arithmetical functions on certain Trigonometrical sums, their applications in the Theory of Numbers and a few short notes on partitions and modular relations constitute his masterpieces and contain the fullest expression of those characteristics which were peculiarly his. The richness and the elegance of the formulae in these papers and the high manipulative skill he displays are something unusual in contemporary mathematical writings.

A few results may be mentioned to illustrate Ramanujan's inductive powers.

Suppose that $g$ is a complex number $|g| < 1$ write

$$1/\prod_{1}^{\infty}(1-g^n) = 1 + \sum_{1}^{\infty} p(n) g^n$$

Then the coefficient of $g^n$ in the series is a very important function of $n$ known as the partition function. It is easily shown to be the number of solutions in positive integers $x, y, z, t \ldots\ldots\ldots$ of

$$x + 2y + 3z + 4t + \ldots\ldots\ldots = n$$

Ramanujan found by observation that $p(5n+4)$ is divisible by 5, and then proved it.

Another result though on a rather different footing found inductively without proof by Ramanujan is

$$1 + \sum_{1}^{\infty} \frac{g^{n^2}}{(1-g)(1-g^2)\ldots\ldots(1-g^n)} = \frac{1}{(1-g)(1-g^4)(1-g^6)(1-g^9)\ldots}$$

What seems remarkable in this formula is that in the product on the Right hand side, the indices of the powers of g are of the form $5n \pm 1$ while on the Left hand side, 5 plays no part in the indices. Such an identity seems very difficult to discover empirically.

The most remarkable result Ramanujan found inductively is one which would have occurred to very few people indeed.

Write

$$g\left\{(1-g)(1-g^2)(1-g^3)\ldots\ldots\right\}^{24} = \sum_{1}^{\infty} \mathrm{T}(n) g^n$$

where the product is associated with the important modular function $\Delta(\omega_1, \omega_2)$ so that it can be expected that the coefficients $\mathrm{T}(n)$ are also important. Then Ramanujan conjectured that

$$\sum_{1}^{\infty} \mathrm{T}(n)\, n^{-s} = \frac{\pi}{p} \left\{ 1 - \mathrm{T}(p) p^{-s} + p^{11-2s} \right\}^{-1}$$

where the Right hand side is extended over all primes $p$. The identity implies in particular that $\mathrm{T}(mn) = \mathrm{T}(m) . \mathrm{T}(n)$ where $m$ and $n$ are prime to each other.

Ramanujan also conjectured that if $p$ is a prime number $\mathrm{T}(p) < 2\, p^{\frac{11}{2}}$ whence it follows that $\mathrm{T}(n)$ is of order of magnitude $n^{\frac{11}{2}} + e$ but no one has ever proved this.

The most pregnant result stated by Ramanujan is that the coefficient of $x^n$ in $(1 - 2x + 2x^4 - \ldots\ldots\ldots)^{-1}$ is the integer nearest to

$$\frac{1}{4n} \left( \cosh \pi \sqrt{n} - \frac{1}{\pi \sqrt{n}} \sinh \pi \sqrt{n} \right)$$

This statement is false, but the formula is a genuine approximation though not so close as Ramanujan imagined.

Definite Integrals greatly interested Ramanujan. It will suffice to mention the following:

$$\int_{0}^{\infty} x^{s-1} \left\{ f(0) - x f(1) + x^2 f(2) - \ldots \right\} dx$$

$$= \frac{\pi}{\sin \pi s} f(-s)$$

The result is purely a formal one.

Ramanujan was the first to evaluate in a characteristically original way, definite Integrals such as $\int_{0}^{\infty} \frac{\cos t\, x}{\cosh x} . \cos m x^2 dx.$

Another result mentioned in an early letter to Hardy dealt with a lattice point problem which can be expressed as follows: To find the number of positive Integer values of $x$, $y$ for which $ax + by \leqslant n$ where $a$, $b$ are given and $n$ is large which problem led to very interesting developments.

Much more important were Ramanujan's contributions to the questions of the representation of numbers as sums of squares, that is for given $k$, $n$ to find the number $r_k(n)$ of solutions in integers $x_1, x_2, \ldots\ldots\ldots x_k$ of $x_1^2 + x_2^2 + \ldots\ldots\ldots\ldots + x_k^2 = n$. If we write $\theta g = \sum_{m=-\infty}^{\infty} g^{x^2}$ the question reduces to that of finding other expressions in powers of $g$. Thus as shown by Jacobi

$$\theta^3(g) = 1 + 4 \left( \frac{g}{1-g} + \frac{g^3}{1-g^3} + \frac{g^5}{1-g^5} + \ldots\ldots \right)$$

from which $r_2(n)$ is four times the difference between the number of divisors of $n$ of the respective forms $4m + 1$, $4m + 3$.

Ramanujan's methods were peculiarly his own. Probably, no other mathematician has relied so much on his native wit. Most mathematicians find it a great advantage to have as extensive a knowledge as possible of lines related to their own. This increases the possibility of successful research, though sometimes, there is much to be said in favour of attacking difficult problems unhampered by current ideas as to the method of approach.

The publication of the volume of collected papers as "SRINIVASA RAMANUJAN" edited by Prof. Hardy has revealed to a great extent the genius of Ramanujan to all the votaries of mathematics containing valuable contributions of Ramanujan and it is gratifying to note that the University of Madras has taken up the task of publishing it in the form of a book.

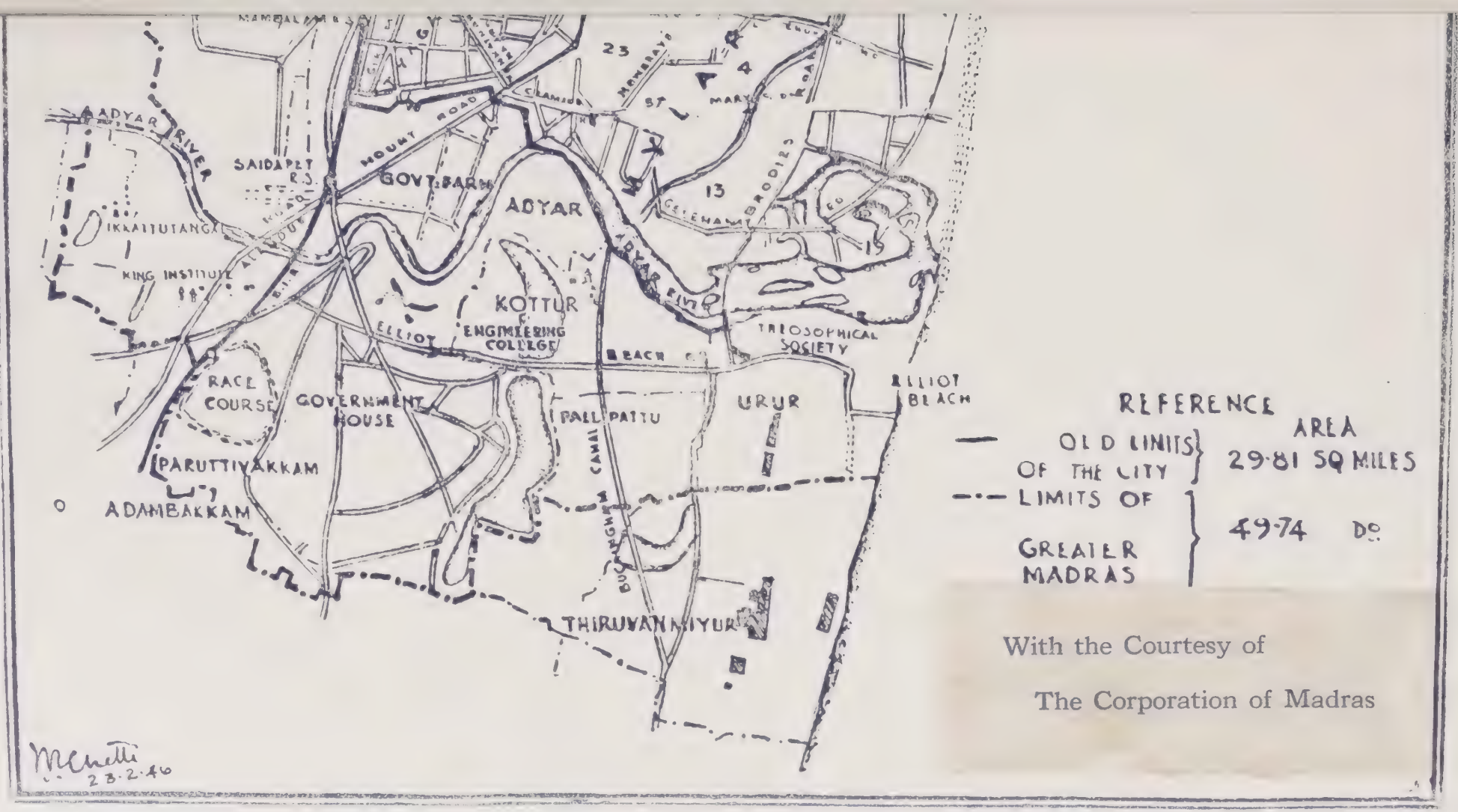
In attempting to assess the standing of Ramanujan as a mathemacian, it is difficult not to be influenced by admiration and wonder at his success in becoming a professional mathematician in spite of greatest difficulties. The estimate depends essentially upon the novelty and importance of his original work. The profound and invincible originality, coupled with his simplicity and the inevitableness of the very greatest work, are vouchsafed only to the achievements of a few, and among the most orginal and the most dexterous of these, there can be no doubt that Ramanujan has an abiding place.

# CONFERENCES OF THE INDIAN MATHEMATICAL SOCIETY

With the Conference at Madras this year, the Indian Mathematical Society will be completing sixteen biennial conferences. The following tabular statement gives details regarding the venue of all these conferences, year and days on which they have been held together with the names of the presidents and names of the distinguished men that inaugurated these conferences. Although the total number of papers is no indication of the quality of mathematical researches conducted in India, still the number of papers read at each conference given in the last column of the table presents a quantitative picture of the activities of the members of the Society.

| Serial No. | Venue of the conference | Year | Days of the conference | Inaugurated by | President of the Session | Total No. of papers read |
|---|---|---|---|---|---|---|
| 1 | Madras | 1916 | December 27, 28, 29 | H. E. Lord Pentland, Governor of Madras. | Prof. A. C. L. Wilkinson. | 13 |
| 2 | Bombay | 1919 | January 11, 12, 13 | The Hon'ble Mr. C. Carmichael, Senior Member of the Executive Council, Bombay. | Do. | 16 |
| 3 | Lahore | 1921 | March 26, 27, 28 | H. E. Sir Edward Maclaughin, Governor of the Punjab. | Mr. H. Balakram. | 15 |
| 4 | Poona | 1924 | April 15, 16, 17, 18 | The Hon'ble Mr. B. V. Jadhav, Minister for Education, Bombay. | Do. | 28 |
| 5 | Bangalore | 1926 | April 2, 3, 4 | ..... | Mr. V. Ramaswamy Aiyar. | 30 |
| 6 | Nagpur | 1928 | December 24, 25, 28 | Sir C. V. Raman, F.R.S., Director, Raman Institute, Bangalore. | Do. | 39 |
| 7 | Trivandrum | 1931 | April 3, 4, 5 | Mr. V. S. Subramanya Aiyar, Dewan of Travancore. | Prof. M. T. Naraniengar. | 31 |
| 8 | Bombay | 1932 | ... | H. E. Sir Fredrick Sykes, Governor of Bombay. | Prof. P. V. Seshu Aiyar. | 35 |

| Serial No. | Venue of the Conference | Year | Days of the conference | Inaugurated by | President of the Session | Total No. of papers read |
|---|---|---|---|---|---|---|
| 9 | Delhi | 1935 | December 18, 19, 20, 21 | The Hon'ble Sri G. S. Bajpai, Member, Viceroy's Executive Council. | Dr. R. Vaidyanathaswamy, (in the absence of H. G. Gharpurey). | 30 |
| 10 | Lucknow | 1938 | March 15, 16, 17 | The Hon'ble Pandit Govind Ballabh Pant, Premier of U.P. | Dr. R. Vaidyanathaswamy. | 40 |
| 11 | Hyderabad (Deccan) | 1939 | March 15, 16, 17 | The Hon'ble Nawabh Mehdi Yar Jung Bahadur, Member for Education | Dr. N. R. Sen | 55 |
| 12 | Aligarh | 1941 | December 27, 28, 30 | Sir Ziauddin Ahmed, Vice-Chancellor, Aligarh Muslim University, Aligarh | Dr. R. Vaidyanathaswamy | 53 |
| 13 | Annamalai Nagar | 1943 | December 28, 29, 30 | Mr. M. Ruthnaswami, Vice-Chancellor, Annamalai University | Prof. F. W. Levi | 50 |
| 14 | Delhi | 1945 | December 21, 22, 23, 24 | Sir B. N. Rau, Leader of the Indian Delegation to the U.N.O. | Do. | 49 |
| 15 | Waltair | 1947 | December 22, 23, 24 | H. H. The Maharaja of Jeypore, Pro-Chancellor, Andhra University, Waltair | Prof. M. R. Siddiqui | 34 |
| 16 | Madras | 1949 | December 26, 27, 28, 29 | Sir C. V. Raman, F.R.S., Director, Raman Institute, Bangalore | Dr. A. Narasinga Rao | — |

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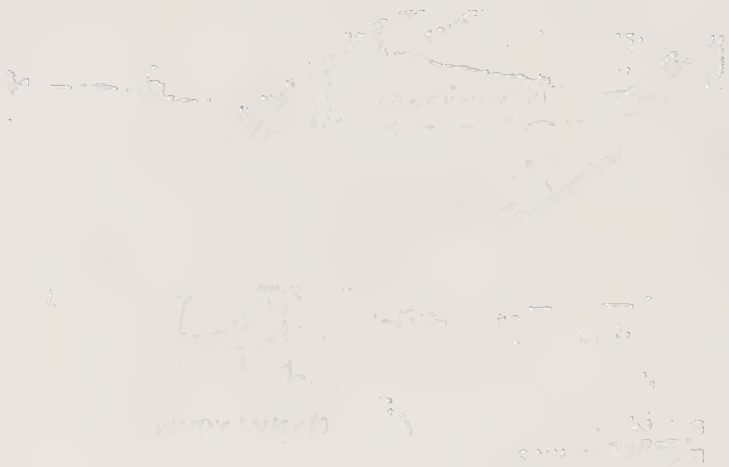

# MADRAS—ORIGIN AND GROWTH

BY

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Madras, the oldest of the modern cities of India, has had an interesting history during the last three hundred years and more. Though the region round about Madras had played a considerable part in the religious and cultural history of South India from very early times, when Francis Day rented on 22nd August 1639 a small coastal strip $3\frac{3}{4}$ miles by one mile to the north of San Thome from Damarla Venkatappa, the nayak of the country between Pulicat and San Thome, no one anticipated that it would become the nucleus of the modern Madras and grow within a few decades of its foundation into one of the important cities of India. Madras was nurtured amidst the clash of arms and the sound of the trumpet and the bugle in the 17th and 18th centuries.

Though the home authorities and the Surat Council were not very enthusiastic about the starting of a fresh factory on the Bay coast by the British East India company, Francis Day, the chief of Armagaon and Cogan of the Masulipatam Council started the construction of a new factory early in 1640 and completed the inner part of it by the 23rd April of the same year which was St. George's day as a result of which the Fort came to be called Fort St. George. The English merchants had their houses in what was called the outer fort, to the north of the inner fort. The foundation of Fort St. George soon attracted a number of families of weavers and painters who migrating from the surrounding country settled down in the village to the north of the fort. It had been founded earlier by Damarla Ayya, a brother of Damarla Venkata in order to prevent the frequent fighting between the Dutch at Prlayakaveri (Pulicat) and the Portuguese at San Thome and was called Chennapatnam after Chennappa Nayaka, the father of the Damarla brothers. The area between the Indian colony of Chennapatnam and the English fort was called Madraspatnam, about the origin of which name however there are many interesting theories. According to one view the name is derived from the Christian name of Madaresan, the head fisherman of the place. A second view is that it is derived from Madras, a Portuguese family settled in the village. The third view is that it is derived from the name of a church of St. Mary (Madras-deDeus) which was in Madras even before 1640. A fourth view is that the word is derived from the term Madhyarajya, lying between Pulicat and San Thome.

After the decline of the Vijayanagara empire the Muslims came into the possession of the Carnatic and the English maintained friendly

relations with them. In 1699 the Mughal Emperor granted to the English the three suburban villages of Egmore, Purasawalkam and Tondiarpet. In 1798 five new villages which included Tiruvorriyur, Nungumbakkam and Vyasarpadi were given to them by Nawab Daud Khan of the Carnatic and the grant was confirmed by the Mughal Emperor in 1717. Three more villages, viz., Vepery, Perambur and Puduppakam were acquired by the English in 1742 from Muhammad Sayyid, the nawab of the Carnatic who was then residing in Madras after the assassination of his father Safdar-Ali. Many other suburbs also developed in their period.

In the course of the first Carnatic war (1744-'48) Madras fell into the hands of the French who were in occupation of the city for three years. During that period they demolished many homes in the Indian area to the north of the Fort and formed a glacis with debris but the city came again into the hands of the English in 1749. The Tamil merchants and others who had abandoned Madras when the French occupied the place returned back to the city in 1749. Ananda Ranga Pillai, the Diarist of Pondicherry while recording it says: "We do not know where the Tamils were who left Madras and would not return in our time; but when their English flag was hoisted ten lakhs of Tamils, Muhammadan Lubbays, Pattanawars collies etc., crowded into the city as joyfully as though the Fort and the town belonged to each one of them". Between 1752 and 1772 the fort underwent repairs, renovations and alterations. Nawab Muhammad Ali Walajah who wanted to have a permanent residence in Madras erected the Chepauk Palace to the south of the Fort, and provided for it a large garden covering an area of about 118 acres. During the governorship of Macartney (1781-'85) Stephen Popham, a solicitor practising at Madras reclaimed and developed the low lying land between the two pettahs, Muthialpettah and Peddunaickenpettah and laid a road, which is the modern Broadway. During the governorship of Lord Clive II (1789-1803) the Banqueting Hall (now called the Rajaji Hall) was constructed near the new Government House.

On the 28th September 1688 was inaugurated the Corporation of Madras under a charter of the company. Besides the Mayor who was the President there were twelve Alderman (three English members of the Council, three Portuguese merchants, three Jewish merchants and three Hindus) and sixty Burgesses. The Major and the Alderman were a court of Record, while the Mayor and three of the Aldermen were the Justices of the Peace. The Judge of the Supreme Court of Judicature was the Recorder of the Corporation. The Corporation was made responsible for conservancy and policing. But from 1792 the Justices of the Peace were appointed to be in charge of municipal administration, and they were empowered to appoint the necessary staff to clean the streets. This arrangement continued till 1856 when by the passing of the India Act the administration of the city was vested in a President,

two Vice-Presidents and 32 commissioners. The Act was superseded from time to time by other Acts.

During the governorship of Sir Archibald Campbell (1786-'90) a Committee was formed for the regulation of wages and prices. In 1797 a regular police scheme was instituted and a committee of police was formed which included a clerk of the Market and a Kotwal besides an assistant.

About 1675 much improvement was effected in the working of the choultry court which administered justice for the Indians and for trying criminal and civil offences by jury a Superior Court of Justice presided over by the Governor and Council was established. After the restoration of Madras to the English by the French in 1749 a Court of Requests was created for deciding petty civil suits as also the court of Quarter Sessions constituted by the President and members of the Council. In 1798 the old Mayor's court was absorbed into the newly created Recorder's court. In 1809 with the abolition of the Choultry court a new Supreme Court was started with the Recorder as its Chief Justice. The Madras High Court was formed in 1852 by the amalagamation of the Sudder and the Supreme Courts.

A number of educational institutions were started in the thirties of the last century which became the nucleus of some of the big colleges in the city now. The recommendations of Wood's Despatch were given effect to by the creation of the Department of Public Instruction in 1854. By Act No. XXVII of 1857 of the Legislative Council of India, the University of Madras was started in September 1857, closely following the construction of a number of handsome buildings such as the General Post Office, the Presidency College and the Senate House, all facing the sea and the conversion of the Chepauk palace into a pile of buildings to accommodate a number of Government offices the Marina "one of the chief lungs of the city" was made. In 1889 the new High Court building was constructed and was followed by that of the Law College. The present University Buildings were completed in 1936.

Madras has thus grown to its modern size little by little in the course of the 17th, and 18th centuries. Hence it is that this "queen among cities" is one of the most extensive in India with large green vegetation and many garden houses in it. It is one of the most attractive cities "with less of contrasts of beauty and ugliness, of wealth and poverty and of fine residential suburbs and slums and chawls as in other Indian cities".

# THE GREATER MADRAS

BY

C. V. NARASIMHAM, M.A., B.L.,
*Commissioner, Corporation of Madras*

It is the cherished wish of the citizens of Madras and the Corporation to make Madras "the City Beautiful". But no city, however, beautifully planned and laid out, can be beautiful in the best sense of the term unless it can also claim to be a healthy city. First things should come first and the emphasis should, therefore, be primarily laid on health and then on beauty.

Although the city enjoys certain natural advantages which even the mischief of man has not been able to spoil, still there is considerable scope for improvement. In recent years great strides have been made in the matter of the city's conservancy, health sewage and drainage.

With a view to developing the suburbs of the city and thereby relieving to some extent the congestion in the most thickly populated areas like George Town and Triplicane, the city limits have been extended by bringing an additional area of 20 sq. miles under the jurisdiction of the Corporation. The total area of the City is now 49.74 sq. miles.

*Housing*:

The average density per house in the city is estimated at 14 and the need for more houses is full appreciated by the Corporation. But with its limited resources and increased debt charges the Corporation by itself cannot solve this problem. There must be a separate body such as a Housing Corporation in which all the property owners in the city should be shareholders to finance all housing schemes within the city of Madras which are designed to provide houses for the working classes and other low paid groups. Construction of houses for the rich and upper middle classes may be left to private enterprise.

The Corporation has been constructing tenement, year after year, for the purpose of housing its own employees and also other deserving poor. So far, it has constructed 2,000 tenements in different parts of the city at a cost of over Rs. 30 lakhs. This year the Corporation has taken a loan of Rs. 3.0 lakhs to construct some more tenements and about 40 tenements are nearing completion. As the present cost of construction of tenements is very high, the Corporation has also launched upon a programme of constructing plinths and allotting them to the Corporation employees so that the employee himself may put up a thatched hut on each plinth. It has constructed 170 plinths so far and provided each one of them with water supply and a flushout latrine. Roads are laid sewered and lighted.

In order to provide accommodation temporarily for those who come to the city in search of employment, 'Homes for the homless' have been constructed in 7 different parts of the city at a cost of over Rs. 2.5 lakhs. These provide accommodation for about 250 families.

As the lower middle classes are in a very sad plight in respect of housing, the Corporation undertook a housing scheme called the Shenoy-Nagar Housing Scheme in Aminjikarai. The scheme provides for the construction of 1,000 houses of which 150 have already been put up and occupied and 75 more are under construction. This colony has already been sewered and lighted. The scheme is expected to be completed in 5 years.

*Water Supply*:

The water supply for the city is obtained from the Kortalayar River and its tributaries and the supply is drawn directly from the Red Hills Lake, which is situated about 8 miles to the northwest of Madras on the Great Northern Trunk Road. The works connected with the diversion of water from the Kortalayar River into the Red Hills lake were completed in 1870. The Red Hills lake has a storage capacity of 1980 million cubic feet above the level. Owing to the rapid increase in population a second reservoir was found essential and a dam across the Kortalayar River was constructed at a cost of Rs. 65.0 lakhs at Poondi in the year 1944 to form a reservoir. The Poondi Reservoir subsequently named as Satyamurthi Sagar is for impounding the greater flood discharges of the river and it has a holding capacity of 2,500 million cubic feet. With a view to utilising the extra storage of water in Satyamurthi Sagar for the city consumption, a second conduit from Red Hills to Kilpauk, a distance of $7\frac{1}{2}$ miles, was constructed at a cost of Rs. 55.0 lakhs. This was opened by His Excellency the Maharajah of Bhavnagar, Governor of Madras, 26th October 1949. A separate trunk main for South Madras is being laid at a cost of about Rs. 21.0 lakhs and when this is completed South Madras will have copious supply of water. A bold step has been taken by the Corporation in having sanctioned the installation of mechanical filters at a cost of Rs. 77.5 lakhs for filtration and purification of the city water supply and the proposal has been submitted to Government for technical and administrative sanction. The installation of a third electrical pumping unit at a cost of Rs. 1.50 lakhs is under progress.

Except during unfavourable seasons an average supply of 24 million gallons of water per day is being maintained in the city. This quantity of water works out to 17 gallons per head per day for a population of 14 lakhs.

In order to ensure sufficient protected supply of water to the city despite the failure of monsoons, the Government have been requested to investigate new schemes like the Krishna-Pennar scheme and the Krishna-Buckingham canal scheme.

*Drainage*:

The Corporation realised more than ever that if the city should be healthy and free from insanitation and fly nuisance the unsewered areas must be sewered as quickly as possible, dry latrines should be converted into flushout ones and each house should be connected up to the nearest sewer so that the entire house sullage can find its way into the sewer without its stagnating in and around the house and making the whole place insanitary. Individual flushout latrines have been provided to the houses of the poor instead of constructing community latrines for a cluster of huts; flushout latrines have also been provided in slum areas like Palmyrah Kuppam, Nariangadu, Sivarajapuram and Gray Nagar Pallam. In low lying areas of the city storm water drains have been constructed with a view to relieve flooding and save the slums from inundation. In addition fresh sewers have been laid in Theagarayanagar, Perambur, Vyasarpady and in the two new housing colonies viz., Shenoy Nagar in Aminjikarai and Gandhi Nagar in Adyar.

Departmental Buildings, University of Madras

Senate House, The Venue of Conference

## THE UNIVERSITY OF MADRAS

The University of Madras which is one of the oldest among Indian Universities and is having at present about 40,000 students studying in different arts, sciences and professional colleges, like most other institutions, had a very humble beginning. It was in the year 1841 that the 'department of the University denominated the High School' was established under the Chairmanship of George Norton mainly for the spread of English education and for the study of literature, philosophy and science. A few years later the University of Madras was incorporated by an Act dated 5th September 1857 primarily for the purpose of conducting examinations. Accordingly the first entrance examination was held in September 1857 and the first examination for the B.A. degree was held in February 1858. This institution thus started was not for teaching but for conferring degrees.

In the year of its inception the University of Madras had only 47 students but this institution rapidly grew in strength and influence and by 1904, the total number of students rose up to 15,434. Since then the Universities of Mysore, Andhra, Annamalai and Travancore have been constituted, and a number of colleges that were originally affiliated to the University of Madras have been included in these Universities. In spite of a considerable reduction in the area covered by the University of Madras, there are during the current year 1949-50, 34,512 students studying in various Arts and Science Colleges and 4,506 students undergoing training for various professional degrees in colleges affiliated to this University.

Under the Act of 1904, the University had jurisdiction not only over the Madras Province but over the adjoining Indian States. In 1923, the University was provincialised by the Amendment Act of that year. Nevertheless some colleges in Hyderabad and those in Pudukottah are still affiliated to this University.

Though designed originally to be an affiliating and examining body, after 1904, the need for advanced studies was felt and with the help of a special grant made by the Government in 1911, the new University Departments in Economics, Indian History and Archaeology were started for initiating and conducting research in these respective branches. Since 1923 a number of research departments were established in Mathematics, Philosophy, Botany, Zoology, Biochemistry, Politics and Public Administration, Geography, Indian Music and in various languages Sanskrit, Tamil, Telugu, Kannada, Malayalam, Arabic, Persian and Urdu. Recent additions to this list are the departments of statistics, anthropology and psychology. These departments are engaged chiefly in research work but some of them give regular instruction for the part-

time diploma courses conducted by the University in Economics, Politics and Public Administration, Statistics, Anthropology and Journalism. The University conducts also certificate and diploma courses in Modern European Languages, French and German with the help of part-time lectures. In addition the teachers of the University departments give inter-collegiate lectures for students of the constituent colleges in advanced branches and also deliver extension lectures for the benefit of research workers and for those appearing for the honours and M.A. degree examinations.

The main administrative office of the University was located originally at the Senate House built in 1874, which is the venue of the 16th conference of the Indian Mathematical Conference. With the rapid expansion of the activities of the University and the creation of the research departments the need was felt for adequate accommodation and in September 1936 the University completed an extensive building scheme at a cost of over Rs. 20 lakhs. The imposing structure of the University buildings on the Marina accommodates at present the large administrative office and also the research departments and the Madras University Library. The three research laboratories for Zoology, Botany and Biochemistry are situated to the south-west of these new buildings.

The Madras University Library has a collection of 1,42,089 volumes of which 1,16,596 are in the main library and the remaining 25,493 are in the departmental libraries and every year 4,000 new books are added to this large collection. In addition the library subscribes to a large number of about 2,036 periodicals. Excellent facilities are available for reading in this library and it is open to all graduates and collegiate students.

The University maintains a student's information Bureau whose primary function is to provide the necessary information regarding foreign universities and if possible recommend and secure admission into various courses of studies available in them.

In recent years there has been a great demand for information from this bureau and the University expanded the activities of the bureau by appointing a whole-time secretary to furnish information and to advise students that approach the University in connection with higher studies abroad.

The principal events in the evolution of the history of University education in Madras in recent years can broadly be placed under two categories, namely, the phenomenal increase in the number of colleges affiliated to the University and the expanded facilities provided for several courses of studies upto the degree post-graduate, and research standards.

There are at present 99 institutions affiliated to the University consisting of 58 Arts and Science Colleges, 15 professional colleges, 25

oriental title institutions and one for fine arts particularly Indian Music. Of these, 19 colleges are situated within the territorial limits of the University and are called constituent colleges and the remaining 53 are affiliated colleges located at various important centres of South India. Of these 53, 12 are second grade colleges preparing students for the Intermediate examination, 27 first [illegible]

## NUMBER OF STUDENTS IN 1949-'50

*Intermediate and Degree Courses*

| Course | Constituent Colleges | | | Affiliated Colleges | | | All Colleges | | |
|---|---|---|---|---|---|---|---|---|---|
| | Junior | Senior | Total | Junior | Senior | Total | Junior | Senior | Total |
| Intermediate... | 2,077 | 1,878 | 3,975 | 10,560 | 9,049 | 19,569 | 12,637 | 10,907 | 23,544 |
| B. A. ... | 632 | 436 | 1,068 | 2,215 | 1,927 | 4,142 | 2,847 | 2,363 | 5,210 |
| B. Sc. ... | 648 | 478 | 1,126 | 925 | 816 | 1,741 | 1,573 | 1,294 | 2,867 |
| B. Com. ... | 179 | 161 | 340 | 502 | 392 | 894 | 681 | 553 | 1,234 |

*Honours and Post-Graduate Courses*

| Course | Constituent Colleges | | | | Affiliated Colleges | | | | All Colleges | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1st year | 2nd year | 3rd year | Total | 1st year | 2nd year | 3rd year | Total | 1st year | 2nd year | 3rd year | Total |
| B. A. (Hons.) ... | 248 | 317 | 256 | 821 | 136 | 144 | 158 | 438 | 384 | 461 | 414 | 1,259 |
| B. Sc. (Hons.) ... | 67 | 84 | 74 | 225 | 32 | 38 | 33 | 103 | 99 | 122 | 107 | 328 |
| B. Com. (Hons.) ... | 21 | 24 | — | 45 | — | — | — | — | 21 | 24 | — | 45 |
| B. O. L. (Hons.) ... | — | 12 | 13 | 25 | — | — | — | — | — | 12 | 13 | 25 |

time diploma courses conducted by the University in Economics, Politics and Public Administration, Statistics, Anthropology and Journalism. The University conducts also certificate and diploma courses in Modern European Languages, French and German with the help of part-time lectures. In addition the teachers of the University departments give

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oriental title institutions and one for fine arts particularly Indian Music. Of these, 19 colleges are situated within the territorial limits of the University and are called constituent colleges and the remaining 53 are affiliated colleges located at various important centres of South India. Of these 53, 12 are second grade colleges preparing students for the Intermediate examination, 37 first grade colleges preparing for Intermediate, B.A., B.Sc., B.Com. examinations and three are affiliated upto honours standard besides four professional colleges. The total strength in the constituent colleges in the current year 1949-50 is 7,625 and among the affiliated colleges the first grade colleges have 24,607 students and the IInd grade colleges have 2,280 students undertaking training for various courses. Details of the number of students studying for different courses are given at the end of the article. There has been a tremendous increase in the total number of students studying in various institutions affiliated to the University in recent years recording nearly a two-fold increase in the last decade.

Among the recent developments of the University in regard to study and research, mention must be made of the College of Technology which the University has started with the help of a munificent donation from Sir Alagappa Chettiar and with a considerable financial assistance from the Government. Further the University has been making every attempt to provide instruction in all courses of study and have started recently B.Com. (Hons.), B.A. (Hons.), and B.Sc. (Hons.) courses in Geography on an inter-collegiate and university co-operation and the Diploma in Tuberculosis. The latest addition this year is the starting of regular courses leading to the M.Sc. degree by examination in mathematics and in chemistry. These courses are designed to give the necessary training for higher research in the respective subjects.

The rapid expansion of various activities of the University is mainly due to the unsparing efforts of the Vice-Chancellor, Sir A. L. Mudaliar, who with this wide experience and exceptional forethought has been guiding the University for the last nine years.

With the growing importance of study and research the University of Madras has been able to provide necessary facilities for new branches of study and expand its activities to cater fully to the needs of the constituent and affiliated colleges.

# RESEARCH FACILITIES IN MADRAS IN PURE SCIENCES

BY

T. S. SADASIVAN, M.Sc., PH.D.,
*Professor of Botany, University of Madras*

The University of Madras, by virtue of its position of being one of the largest and oldest Examining Bodies in India, had been mainly an affiliatory body and did not concentrate on Research activities in Science until about twenty five years ago. The first landmark was the starting of four Science Research Departments, Mathematics, Zoology, Biochemistry and Botany. Mathematics was the earliest arrival, having been started in 1927, the other three commencing their activities between the years 1930 and 1933. The Department of Statistics came in later in 1941 but it must be said that it was ushered in at a time when the importance of the subject in any programme of Scientific Research became increasingly obvious. Until the year 1930, therefore, original scientific publications appeared, rather sporadically, in some of the affiliated and constituent institutions in the basic sciences of Chemistry, Physics, Botany, Zoology and Geology. It must be emphasised here that, by and large, post-graduate teaching upto the B.Sc. (Honours) stage is concentrated in the city of Madras in three of the constituent colleges, the Presidency College, the Loyola College and the Madras Christian College. These institutions have in the past acted as 'feeders' to the research courses culminating in the research degrees of Master of Science and Doctor of Science. With the institution of the degree of Doctor of Philosophy in 1944, the long felt need of a 'Junior Doctorate' has come to be. This University, therefore, is now *on par* with many other Universities, both at home and abroad, especially now, when it has been felt desirable to 'tighten up' the regulations for the award of the Doctor of Science degree which is conventionally regarded as a post-Ph.D. degree awarded to an outstanding investigator who has not only produced evidence of original publications in his subject of choice but also built round himself an active research team. That is how it ought to be and in this regard, this University has set itself a high standard in keeping with its long tradition.

The following paragraphs would denote that, primarily the Research output, in the past, had been in Mathematics, Botany, Zoology, Organic Chemistry and Biochemistry much to the exclusion of work in Physics, Geology and other branches of Chemistry, although considerable emphasis is now being laid on Physical Chemistry, Physico-organic Chemistry and Geology in three of the institutions. This is a happy augery, since in the context of modern University Research, no programme of fundamental work could remain isolated. Indeed, there is

Presidency College, Triplicane

Madras Christian College, Tambaram

every indication and need to collaborate and draw new ideas from specialists and forge together a system of 'collective security' in fundamental research, without which much of the results of our efforts may not reach a stage of fruition.

## UNIVERSITY DEPARTMENTS OF RESEARCH

1. *Mathematics Department*:

The Department has been functioning for the last 22 years. During this period publications have been issued on the following subjects:

Algebraic Geometry and Invariant Theory.
Determinant-theory (including determinants of higher dimensions).
Group-theory and Modern Algebra.
Multiplicative Arithmetic Functions.
Tensor Calculus and differential geometry.
Symbolic Logic.
General Topology.
Partially ordered sets; in particular Distributive Lattice and Booban Algebra.
Linear spaces, and Fourier Analysis.
Integral Functions.
Foundations of Projective Geometry.

The problems now receiving attention are: (i) General Topology (ii) Distributive Lattice, and (iii) Tensor Calculus and Pfaff's Problem.

During the present year M.Sc. (Group I) course with the four subjects Topology, Linear Function-spaces, Theory of Probability and Quantum Mechanics, is being conducted. In addition it is proposed to conduct M.Sc. Group II course with the four subjects Modern Algebra, Theory of Representations of Groups, Foundations of Projective Geometry and Quantum Mechanics in the next year Research and higher study by students of the Department are expected to centre round these subjects of the two M.Sc. Groups for the next few years.

2. *Bio-chemistry Department*:

*General Bio-chemistry*: Enzyme systems involved in the metabolism of proteins and carbohydrates both in plants and in animals, interrelationships between vitamins, hormones and amino-acids, micro-analytical procedures for the analysis of biologically important compounds.

*Protein Chemistry*: The structure of proteins and the relation of physiological activity to structure; isolation and occurrence of the rarer amino-acids; chemical modification of biologically active proteins, hormones and enzymes; denaturation and its reversal.

*Nutrition*: Changes in intermediary metabolism in various nutritional deficiencies; characterization of various deficiencies by measurement of such changes; the relation of nutritional status to carcinogenesis;

the inter-relationships between vitamins and other essential nutrients like unsaturated fatty acids and the indispensable amino-acids; liver cirrhosis.

*Fermentation*: Citric, oxalic and gluconic acid fermentations by fungi; the industrial utilization of microbiological activity.

The laboratory is extremely well equipped for biochemical work and has an animal house for experimental work.

3. *Botany Department*:

*Plant Pathology*: Study of Soil Fungi—their pathology and physiology with special reference to host parasite relationship. Study of fungal floras of soils with special reference to micro-ecology.

*Algology*: Cytology, life-histories and taxonomy of South Indian Algae. Limnology of South Indian waters is a special line of investigation.

The laboratory has attached glass houses and has a complete hydrobiological outfit in addition to having all necessary equipment for general plant pathological investigations.

4. *Zoology Department*:

The investigations carried on in this department are chiefly marine biological:

The feeding habits, digestive system and fat contents of fishes are studied. Embryological studies in the ophiocephalus is a feature. Life histories of the more common fishes of food value occurring in the plankton are worked out. Analysis of the plankton of the Madras coastal waters for the occurrence of Copepods and pelagic molluscs, which form the food of fishes, is undertaken as a long range problem.

Other investigations of interest are: The biology and embryology of prawns and shore crabs and their capacity to invade brackish estuarine regions; excretory organs of Gasteropods, bivalves and of polychaetes of estuarine origin with special reference to their osmotic adjustments; parasites of fishes are a special line of investigation.

The laboratory is ideally suited for marine biological investigations.

5. *Statistics Department*:

Started as an appendix to the department of economics in 1931 the the post of the lecturer in statistics was separated in 1941 and was constituted into an independent department of research. The growing importance of the applications of statistical methods in experimental research in Sciences and in humanities prompted the University to institute a two year part time diploma course in statistics in the same year. From the beginning this post-graduate diploma course in statistics has been very popular and during the current year there are 41 students in the junior class and 35 in the senior class. In addition facilities are also available in this department for research work in statistical methods and

their applications in different branches. At present the main branches of work are on testing of hypothesis and on the analysis of time series. Work is also in progress on a number of problems, where statistical methods can profitably be applied, in education and in Social Sciences. This department is also entrusted with the teaching of statistical methods in industry to students of B.Sc. (Technology) class. Although at present the department has only one member on the staff, with the growing importance of the subject there will be considerable expansion of the department so that it will be possible in future to conduct both theoretical and applied work in various branches and also give the necessary assistance to research workers in other departments in their experimental research.

## THE PRESIDENCY COLLEGE

1. *Physics Department*:

The Department specializes in the following lines:

(i) Band Spectra.
(ii) Optical properties of liquids and gases.
(iii) Diamagnetism.
(iv) Band pass filters.
(v) Basic Radar Circuits.

The necessary equipment for these investigations are available in the laboratory.

2. *Chemistry Department*:

This laboratory has had a tradition for research in Organic Chemistry. The problems tackled are:

(i) *Studies in Boric acid*:

Investigations on phosphors formed by ortho-hydroxy carbonyl compounds with boric acid as base are undertaken with a view to find out whether compound formation takes place in the process. Study of the melting points of mixtures of the o-hydroxy carbonyl compounds with boric acid (pure) in varying proportions and construction of phase diagrams are a special feature of the work.

(ii) *Studies in the Benzidine series*:

The rates of coupling of benzidine and substituted benzidines with coupling components have not been studied so far and the work now in progress has, therefore, a direct bearing on the manufacture of Direct Cotton Colours. It is also proposed to study the influence of substitution on absorption in the visible and ultra-violet region for which there is necessary equipment.

(iii) *Other investigations are in pure organic chemistry*:

They include—Amalgams as reducing agents with reference to addition reactions on ethenoid and acetylenic linkages; electrolytic amination

for production of dye intermediates such as nitro anilines etc., and complex formation in pyridine series: Poly pyridyls.

In addition to these problems the laboratory has been engaging its attention on various problems connected with glandular products, hormones etc., and is handling a number of schemes of Research sponsored by the Council of Scientific and Industrial Research of the Government of India.

3. *Geology Department*:

Facilities are available in this Department for petrological research. Research is being carried out chiefly with reference to the igneous and metamorphic complex in selected areas which it is hoped, will lead to a clear understanding of many problems connected with Archaean Geology. The charnockites of the type area, the gneissose granites associated with traps round about Nagari, and a very interesting high grade metamorphic complex round about Ganguvarpatti in Madura District, have so far been studied by research scholars of the department. At present studies on the crystalline complex of Sivamalais and some problems connected with Pegmatites of Nellore are in progress. Research is being carried out on the Gondwana beds near about Madras by sedimentary petrographic methods.

The department is well equipped for petrological work and chemical analytical work on rock compositions.

4. *Botany Department*:

This department has been for a long time interesting itself with lower forms of life, particularly, Algae. The problems under investigation are:

The local algae, fresh-water and marine are being studied in detail with some stress on the ecological aspect. Also the algal flora of the natural and cultivated soils of the locality is under observation in liquid and solid media. Also studies on the ecology and systematics of Bacteria of the local Adayar backwaters is in progress. Attention is paid to the morphology and distribution of flowering plants, autecology etc., in and around Madras with additional emphasis on ecological anatomy. In addition studies on the prothallus development in *Angiopteris* and the morphology of flowers of *Opilia* are in progress.

5. *Zoology Department*:

This laboratory specialises on the systematics of the local fauna and certain anatomical problems connected with the common pangolin. Work on the physiology of certain marine animals has been recently taken up.

6. *Mathematics Department*:

With the starting of the honours course in statistics, this department has commenced work on problems in Mathematical Statistics.

## THE MADRAS CHRISTIAN COLLEGE

1. *Chemistry Department*:

This laboratory is primarily concerned with the application of physical methods to the study of organic reactions. The reactions at present studied are substitution reactions in saturated systems and addition reactions of ethylene derivatives. By the study of reaction rates at different temperatures and in several solvents both pure and mixtures of solvents, the influence of structure and the role of solvent on the course of the reactions is observed and correlated. Closely related to this is a knowledge of dielectric constants and of dipole moments of compounds. Part of the work is in this direction using a heterodyne. Work is also being started on some auto-oxidation and reduction reactions. On the theoretical side the work is primarily on the correlation of bond properties.

2. *Botany Department*:

The work of this department relates to cytological and cyto-taxonomical studies in Angiosperms. The laboratory is primarily equipped for teaching upto the B.Sc. (Pass) degree and as such only limited facilities exist for research work. Nevertheless, considerable research publications have accumulated during the last few years in the above branches of Botany.

3. *Mathematics Department*:

This department specialises in the following lines:

On theory of numbers; Tauberian Theorems; various problems in analysis; in multivariate statistical distributions; and on the mathematical theory of musical intervals.

## THE LOYOLA COLLEGE

1. *Chemistry Department*:

This department is largely equipping itself for advanced work in Physical Chemistry. The investigations now in progress are:

*Investigation of reaction kinetics in gas phase*:

(*a*) *Homogeneous*—thermal decomposition of metal alkyls, the high vacuum set-up is under erection.

(b) *Heterogeneous*—vapour phase catalytic decomposition of an Indian oil. Work on absorption, both physical and chemical, of gases on various catalytic surfaces is to be undertaken presently.

*In the high polymer field*:

Chemical investigation of the main constituent of cashew nut-shell liquid. The reaction kinetics of polymerisation of this substance alone and with other substances will be studied. The kinetics of polymerisation of well known monomers will also be taken up for study shortly.

2. *Mathematics Department*:

This department mainly specialises in Partial Differential Equations called generally "of the elliptic type". This is partly in connection with a few fundamental problems arising out of the Theory of Relativity. These problems are not the "classical" ones, namely the linear problems. New methods are being investigated with a view of ascertaining how far the new methods due to Schauder and Leray—Topological methods—are helpful.

The above brief outline of research activities in the Madras University and affiliated colleges, indicates, in a nut-shell, the general lay-out of the various departments of Teaching and Scientific research. It is needless to emphasise here that, the building up of active schools of research in the basic sciences in the Indian Universities, is an essential pre-requisite to the ultimate industrialisation of the country. It is to be hoped that this brief note would summarise the pattern of research in this City to the distinguished Mathematicians whom we have the honour to welcome to this Centre of Learning.

# TECHNOLOGICAL EDUCATION IN MADRAS

BY

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Facilities for Technological education in the Madras Presidency are of comparatively recent origin. Apart from the Engineering College at Guindy and a few schools of Technology for Leather and Textile industries in Madras and Coimbatore, there were hardly any others until recent times.

There are at present five colleges of Engineering at Guindy, Coimbatore, Anantapur, Annamalainagar, and Cocoanada and three colleges of Technology at Madras, Waltair, and Annamalainagar having courses of instruction leading to a University degree and nearly ten polytechnics of a Diploma standard in the Madras province. The latter have been designed mainly to provide facilities for vocational training of various standards for those who have completed their middle school and high school, to meet the demands for trained hands for manning Industries in the new development programmes. In general, the Polytechnics, cover two types of courses, one of the Diploma standard of 3 year-period full time or 4 to 5 year period part time, and the other of a Certificate standard, of 2 to 3 years duration.

A schedule of the courses in the several polytechnics which are under the management of the Department of Industries, Government of Madras is given at the end of the article. A Technical Advisory body with members drawn from the Industries, Government Departments and University, has also been formed to assist the Department in the matter of technical education and standards.

In addition there are two other well established Polytechnics, the P.S.G. Institute at Coimbatore and C.N.T. Institute, Vepery, Madras, with courses in engineering subjects. Centres for vocational training alone in the Engineering crafts and arts are also run under Government and Private auspices, like the Ramakrishna Trade School, Government Training Centre for Ex-service men, and V. S. Rajagopalan Radio Institute at Madras, Vincent Institute for Radio, and Refrigeration Engineering at Trichinopoly.

While technical personnel with vocational and craft training are highly essential, to man industries, no country can hope to align itself in the forefront of world wide industrial development unless it has the potentiality to design or evolve new industries which can be competitively based on the supply and quality of the raw materials available in the country, on the local climatic and geographic conditions, and on

types of manning personnel available. This potentiality can be developed mainly by a scientific study of the technologies, and training in the methods of Research in science and technology. Instances are not however wanting in which men who have grown up in particular industries over fairly long periods, have struck out on entirely original lines, or effected beneficial departures from established practices. Indeed, not a little part of our present volume of industrial developments can be said to be due to the efforts of such pioneers, who by dint of extra-mural self studies and bold thinking have evolved successful inventions. But such men have been few and far between and their type of pioneering work has now become the subject of organized scientific studies largely with the object of increasing the pace of competitive development and decreasing the role of empirical and chance elements in industrial practice. This is the basis of the modern scientific approach to Technology, now so well developed in Europe and America. Such scientific studies and training for Technologies form properly the domain of University higher education. In the Madras Province facilities for such studies in various physical engineering subjects are available in the Engineering Colleges maintained by Government and affiliated to the Universities. The University of Madras itself took the initiative in providing facilities for corresponding studies and training in other Technologies that are largely based on the chemical and allied sciences, and started an institution in 1944 with courses in Chemical Engineering, Leather and Textile Technologies under the name of 'Alagappa Chettiar College of Technology' after the generous donor who gave an initial donation of Rs. 5 lakhs. This donation, supplemented by other substantial grants from the University funds and Local and Central Governments, is the mainstay of this college. This institution admits only graduates who have majored in chemistry and physics, and have also a minimum basic knowledge of Mathematics upto the Intermediate standard. These post graduate courses cover a period of $2\frac{1}{4}$ to $2\frac{1}{2}$ years including the compulsory periods of practical training in recognised factories. The college is located in an area adjoining the premier Engineering College of the Presidency at Guindy. By official agreement, all the facilities required for practical training in the physical engineering subjects, available in the Engineering laboratories and workshops of the adjoining Engineering College are made accessible for the training of the students of the College of Technology while facilities for the particular training in the Technological and Chemical laboratories are liberally provided in the college itself. The college has specialised equipment such as Filter presses, Distilling columns, Centrifuges, Driers, Absorption and Extraction plants, Evaporators, that are so commonly used in all types of chemical industries, for a study of their design principles and for training in their operation. Similar facilities have been provided in

the University Colleges at Waltair and Annamalainagar. While courses in Chemical Engineering, Sugar Technology, Pharmaceuticals and Foods technology, are provided at Waltair. Annamalainagar has only a course in Chemical Engineering.

It is hoped that with increasing financial aids by way of stipends and bursaries, more facilities will become available for Research and development work in Technology in this province. Modern opinion in the fields of higher industrial education veers more and more to the increasing necessity for a sound education in the Engineering sciences to precede a period of well guided and intensive practical training in the commercially successful industries. This brief opinionative review on the subject of Technological education in Madras can well be concluded with a quotation from a recent address delivered by the President of the American Institute of Paper Technology:

"The fundamental difficulty with graduates who enter industry is not aptitude but attitude. By substituting commercial or vocational courses for fundamental instruction, educators lost sight of the fact that true education is a study of values and not an imitative process. It is a folly to try to equip students with memorised answers for every problem they will encounter in later life. An advancing world will not wait while one runs through the file of his memory in order to see whether there is a ready made answer. Proper education, whether it be scientific or otherwise, should provide an adequate background of values, thereby equipping the student with the ability to think for himself and to meet new situations on terms of broad concept rather than in terms of dated recipes.

About vocational guidance at various levels in our system of education, progress is being made but much yet remains to be done."

## SCHEDULE

I. *Central Polytechnic, Madras*-I:—

(*a*) Diploma courses:—*Full Time*: Cinematography and Sound Engineering, Electrical Engineering, Fisheries Technology and Navigation, Mechanical Engineering, Printing Technology, Sanitary Engineering, and Overseer's Course.

*Part-time*: Electrical Engineering, Mechanical Engineering and Printing Technology.

(*b*) Certificate Courses:—(Part-time). Electrical wiring, Composing and Proof-Reading. Machine Minding, and Binding, Wood Workers drawing, Metal Workers drawing, and Plumbing and Building drawing.

*Full-time*: Cinema Operator's course; Light Metal Casting; Mechanical draftsmanship, Building and structural draftsmanship and Electrical and Gas Welding; Blacksmithy, Fitters and Erectors course.

II. *Tamil Nad Polytechnic, Madura:*—

(*a*) *Diploma courses*: Automobile Engineering, Electrical Engineering, Mechanical Engineering and Overseer's Course.

(*b*) *Certificate courses*: Blacksmithy, Cabinet making, Electrical wiring, Moulding, Toy making.

III. *Arthur Hope Polytechnic, Coimbatore:*—

(*a*) *Diploma course:*—Automobile Engineering.

(*b*) *Certificate courses:*—Auto-Servicing and Radio Servicing.

IV. *Kerala Polytechnic, Calicut:*—

(*a*) *Diploma courses*: Chemical Engineering, Electrical Engineering, Food Technology, Mechanical Engineering and Overseer's Course.

(*b*) *Certificate courses*: Cabinet making, Electric wiring, General Mechanics and Light metal casting.

V. *Karnataka Polytechnic, Mangalore:*—

(*a*) *Diploma courses*: Automobile Engineering, Mechanical Engineering and Overseer's Course.

(*b*) *Certificate courses*: Cabinet making and General Mechanics, Auto servicing and Rattan work.

VI. *A. G. Polytechnic, Vuyyuru:*—

*Diploma courses*: Mechanical Engineering and Overseer's Courses.

VII. *Andhra Polytechnic, Cocanada:*—

(*a*) *Diploma courses*: Electrical Engineering, Fisheries Technology and Navigation, Mechanical Engineering and Overseer's Course.

(*b*) *Certificate courses*: Cabinet making, Electric wiring, General Mechanics, and Hand-loom weaving.

VIII. *Rayalaseema Polytechnic, Bellary:*—

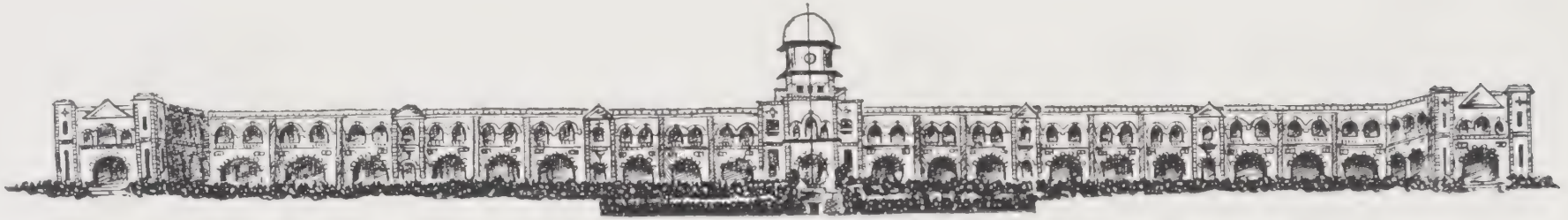
(*a*) *Diploma courses*: Overseer's course and Chemical Engineering.

(*b*) *Certificate courses*: Cabinet Making and General Mechanics.

IX. *Government Coir School, Beypore, S. Malabar:*—

*Certificate course*: Coir and coir products manufacture. Trained Teachers from Local Board and other private schools and boys and girls of 17 years and above with IV form or VIII standard qualification are admitted. No fees and all the candidates are eligible for stipends of Rs. 15 per mensem.

Queen Mary's College, Mylapore



College of Engineering, Guindy

Women's Christian College, Nungambakkam

# INSTITUTIONS FOR COLLEGIATE EDUCATION IN MADRAS

Of the total number of 46 institutions providing courses of instruction leading to the intermediate and degree examinations affiliated to the University of Madras, nine are constituent colleges situated within the territorial limits of the University. Of these, four colleges are exclusively for women and of the remaining five three allow co-education whereas the remaining two admit only boys for the various courses. While three of these nine institutions are run by the Government, three others are under the management of Christian Missionaries and the remaining three are maintained by private trust. During the current year the total strength in all these colleges is 7,625 forming nearly a fourth of the total number of students in all colleges affiliated to the University of Madras. All the four colleges for women provide instruction only upto the degree course in different branches whereas all other five institutions impart instruction for honours and post-graduate courses.

The following paragraphs contain a short account of each one of these institutions. Besides these nine institutions some details of Madras Christian College are also included in this note, although it is not located at present within the territorial limits of the University, as it was shifted from the city only recently.

## THE PRESIDENCY COLLEGE, TRIPLICANE

The foundation of the Presidency College in 1840, was the outcome of a minute written on the 12th December 1839, by Lord Elphinstone, Governor of Madras and the first classes which were of the preparatory grade were started by Mr. Cooper on 15th October 1840. The high school classes were added on 14th April 1841 and designated as the High School of the Madras University! The collegiate department was opened in 1853 and the whole institution was under the control of the president and governors. In 1855, the management of the college was transferred to the newly created department of public instruction and the college then formally assumed the present name. In the same year law classes were opened in the college and continued till 1891, when the law department was constituted into a separate 'Law College'. This institution was first located in the rented building in Egmore, known as the Edinburgh House and in 1841, it was shifted to Popham's Broadway and later to the General Police Office in Egmore. The foundation stone of the present main buildings of the college on the Marina was laid in 1867 by Lord Napier and the opening ceremony of the new buildings was prepared by His Royal Highness the Duke of Edinburgh in 1870. Many additions and

extensions have since been made, the biggest and which was the construction of the Natural Science Buildings which were opened by Lord Erskine in 1938. The college celebrated its first centenary in 1940, in commemoration of which the centenary memorial Dome was constructed. The college provides instruction for the following degree courses—B.Sc., B.Sc. (Hons.), B.A., B.A. (Hons.), and M.A. Facilities are also provided for research to the students for the M.Sc., and M.Litt. degrees and the Government of Madras is awarding research studentships, since last year, one for each subject.

## PACHAIYAPPA'S COLLEGE, CHETPET

The college developed out of the Pachaiyappa Central Institution, which was started in 1842. Devoted from the beginning to the higher education of the Hindu community, the college has the greatest reputation of having many eminent lawyers and judges as its old students. This college was first affiliated to the University as a second grade college and by reason of giving efficient coaching to students entering its portals, was raised to the status of a first grade college in 1889. The college had distinguished personalities as its former principals to shape its growth and development. By the efforts and co-operation of the trustees and principals, the college has added much to its popularity and at present the college has the largest number of students on its rolls. The institution is now housed in two blocks of a new building at Chetpet—one the arts block and the other the science block. Honours courses in Economics, Politics, History and Mathematics were opened in this institution in 1924. This college is the first in the city to open B.Com. course. The college has one of the largest libraries and the economics section of the library has the largest number of useful books.

## THE MADRAS CHRISTIAN COLLEGE, TAMBARAM

Started as a small school for boys in the year 1883 by the Scots Chaplains in Madras in the neighbourhood of Kirk. This institution is the oldest college in the Madras Province. The Rev. John Anderson of the Church of Scotland took charge of this school in 1837 and during this time the school developed quickly and was shifted from Kirk to George Town. In 1867, this institution became a constituent college of the University of Madras which was established in 1857. In 1877, other missionary societies joined the Scottish Church in support of this college and thus it became the Madras Christian College. In 1937, the college moved to the site generously provided by the Government of India at Tambaram, the terminus of the suburban-electric railway. One interesting feature of the College at Tambaram is the Hall system as suggested by a commission, headed by Lord Lindsay which visited the missionary colleges in India during 1930-'31. The teaching and residential halls are not merely hostels, but function almost like colleges within the college. Much of the life of the college

centres round the three halls—Bishop Hebar, St. Thomas's and Selaiyur. The college provides education for the B.A. degree, B.A. (Hons.), B.Sc. degree, B.Sc. (Hons.) courses and various subjects for the Intermediate course. The teaching staff of the college consists of over 70 members and total number of students are 1155 with over 672 students undergoing the degree courses. This institution has also a high school, the Madras Christian College School which is situated at present, in the buildings vacated by the college in 1937, but will be shifted to the new buildings at Chetput.

## THE LOYOLA COLLEGE, NUNGAMBAKKAM

This college was first founded in 1925, by the Fathers of the Jesuit Mission and is situated in the extensive buildings near Kodambakkam. This institution is one of the largest-affiliated colleges of the University of Madras and it imparts instruction for the following degree courses, B.A., B.A. (Hons.), B.Sc. (Hons.), B.Sc., B.Com., B.Com. (Hons.) and in various subjects in the Intermediate class. The college also trains students in Military Science for the war certificate examination and has the 'D' company of the National Cadet Corps.

## THE GOVERNMENT ARTS COLLEGE, MOUNT ROAD

This college was started in 1918, mainly to encourage higher education among muslim community in the Madras as the Madras Mohamedan College and this institution is situated on the Mount Road. The name of the college has been altered by the Government of Madras recently as the Government Arts College. The college imparts instruction for the following courses—B.Sc., B.A., and the Intermediate. Provision is made for teaching Arabic, Persian, Urdu, Tamil, Telugu, Malayalam, Sanskrit, Kannada, and Hindi under Part II for the intermediate class and the first six languages in the B.A. degree class. The strength of the college at present is well over a thousand and the number of the teaching staff is about ninety.

## VIVEKANANDA COLLEGE, MYLAPORE

The phenomenal increase in the demand for facilities for collegiate education is mainly responsible for starting this institution in the year 1946. Opened in June of that year, the college provided facilities in the first year, only for the Intermediate, B.A. with branch (iv) b and (viii), the B.Sc., B.Com., and B.A. (Hons.) Economics were introduced in the year 1947-1948. This is the first of the colleges to introduce B.Sc. (Hons.) in Geography within two years of its inception. The new course of B.Sc. in Statistics, started last year is very popular and is attracting a large number of students. Vivekananda College is the only one in the University offering this course. The college has progressed rapidly in its short history and it has now more than a thousand students on its rolls.

## THE WOMEN'S CHRISTIAN COLLEGE, NUNGAMBAKKAM

This college, founded in 1915 and supported by Christian Missionary Societies from England, Scotland, America and Canada, is located on the College Road, Nungambakkam, in an extensive compound of about 20 acres with wide play-grounds. This is a residential college with an enrolment of 250 students. The main building of the college, 'Doveton House' is a magnificent old 18th century 'Banglow' while the science building is well-designed and equipped. The simple chapel with its colonnades enclosing garden and lotus tank is one of the most beautiful places in the college. The institute provides instruction for the following courses—Intermediate in both Arts and Science, B.A., and Home Science for the B.Sc. degree.

The nutrition department is a particularly interesting feature of this college. There is an animal house where research experiments are conducted on white rats fed on rice diets and other research laboratories where studies are being made on nutritional losses in Indian methods of food preparation. From this department work is carried out into the city and to the adjoining towns and villages by demonstrations and talks on nutrition with practical applications to the problems of the house-wife. Another activity of the college is a nursery school in a slum area near the college. This school which is a recognised nursery school with two qualified teachers, was built and is supported through the joint efforts of the students, staff and almanac of the college.

## QUEEN MARY'S COLLEGE, MYLAPORE

Facing one of the finest beaches in the world, Marina, this institution is the premier Government College for Women in this Province. This college was started in 1914 as the Madras College for Women in a small 'tumble down' house known as the Capper house building and the name of the institution was altered in 1917 into the 'Queen Mary's College for Women', after the gracious permission of Queen Mary. From this humble beginning with only 37 students, the college gradually developed to the present standard with extensive buildings occupying an area about 3/4 of a square mile and with an enrolment of over 650 students. The college in the beginning was teaching only for the Intermediate examination and with the introduction of B.A. degree course in 1926, the institution became a first grade college. B.Sc. degree, B.Sc. (Home Science), B.A. (Hons.), and M.A. (Geography) were started recently. The new college buildings were constructed in 1915 and several extensions were made later to them, prominent among them being, the laboratories for teaching of Physics and Chemistry, which were added in 1929. A new block of buildings for the B.Sc. (Home Science) was completed in 1949. The principal and a number of members of the staff are also residents in

the Hostel along with the students thus guiding their activities. The social service league of the college plays a very important part in the life of the college and it maintains a free dispensary and provides free midday meal for children in the surrounding slum areas, besides educating and teaching them spinning, weaving and needle-work.

## ETHIRAJ COLLEGE FOR WOMEN, ROYAPETTAH

In response to the growing demand for more facilities for higher education of women in the city, the Government of Madras, started college classes in 1946 in the premises of the Hobart School for Muslim Girls at Royapettah, with a temporary affiliation from the University of Madras. In 1948, the college was taken over by a new management under private control with an endowment organized by the Ethiraj College Trust. The institution is now continuing in the same premises under the new management, as a first grade college, but is likely to shift soon to the new buildings, donated by the Founder-Chairman of the Trust, Mr. V. L. Ethiraj in Victoria Cresent Road, Egmore. The courses of study imparted in the college at present include some branches of Intermediate examination and B.A. degree. The total number of students are about 200. There is a students union of the college which provides, practical training in social and civic responsibilities for the students. As a large number of applicants could not find accommodation in the present inadequate premises of the college and to further the cause of social education in the city, the authorities are considering the introduction of a progressive and comprehensive scheme of extra-curricular activities with lectures and practical work.

## STELLA MARY'S COLLEGE, SAN THOME

The growing demand for facilities for collegiate education prompted the Catholic mission to start this institution in 1947. The institution functioned as a second grade college during the first year, but in the year 1948 it was raised to the status of a first grade college imparting instruction to B.A. course in many branches. Extensive and spacious buildings have been constructed during the current year to accommodate this college.

# PROFESSIONAL COLLEGES IN MADRAS

There are fifteen colleges imparting education leading to a professional degree. Affiliated to the University of Madras and of these ten are situated in the city and in the vicinity of Madras. With the exception of the college of technology and three training colleges, the remaining ten institutions in the University are all managed by the Government. The College of Technology is maintained by the University of Madras, whereas the three training colleges are under the management of Christian Missionaries. The ten colleges within the city area are the Engineering College, Guindy, two Medical Colleges, the Law College, four training colleges, the Veterinary College and the College of Technology. Of the remaining five colleges, two are engineering colleges, located in Coimbatore and Anantapur, one is an Agricultural College at Coimbatore, one a Medical College at Vellore and a fifth a Training College at Palamcottai. Of the total number of 4,506 students in all the professional colleges of the University in the current year 1949-'50, 3,570 are in the constituent colleges and the remaining are in the five affiliated institutions.

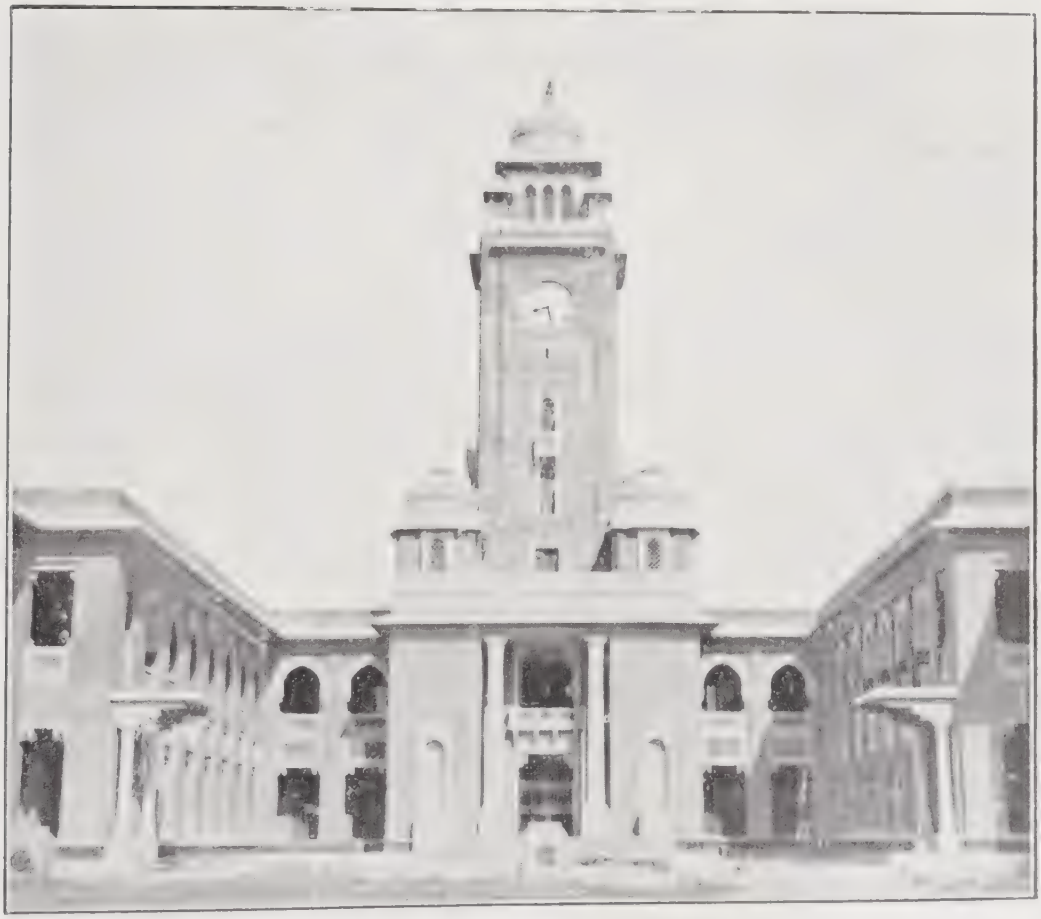
The following table gives the number of students undergoing training different professional courses in the constituent and in the affiliated colleges of the University.

NUMBER OF STUDENTS IN 1949-'50

| | Engineering | Medicine | Law | Teaching | Veterinary Science | Technology | Total |
|---|---|---|---|---|---|---|---|
| Constituent Colleges... | 658 | 1,460 | 659 | 364 | 357 | 72 | 3,570 |
| Affiliated Colleges ... | 463 | 209 | ... | 29 | ... | ... | 936 |
| Total ... | 1,121 | 1,609 | 659 | 393 | 357 | 72 | 4,506 |

The following paragraphs contain details about the various activities in each of the professional colleges, situated within the city. The College of Technology is omitted in this account, as a separate article dealing with the technological education in Madras, contains a detailed information about this institution.

St. Christopher's Training College, Vepery



Research Department, University of Madras

Meston Training College, Royapettah

Madras Veterinary College, Vepery

*College of Engineering, Guindy*

This college, which developed from the survey school established by the East India Company in May 1794, is one of the oldest British Indian Educational institutions and the most ancient Engineering institution in India. Started as a school with only 8 students to be trained as surveyors, this institute was reorganised into a college in 1857, on the model of the one established in Rooke in 1847. This College was first located at 'Kalasmahal' at Chepauk in 1859. In 1894, the University of Madras instituted a degree course in Mechanical Engineering, the first of its kind in India and the college started training students for this course. The college was completely reorganised in 1904, with separate courses for upper and lower subordinates, civil and mechanical engineering. In 1920, the college was shifted to the new college buildings at Guindy and became a residential institution. The college imparts education in different branches of engineering like civil, mechanical, electrical, telecommunication and highway engineering, besides training several types of technicians. This is the first college in India to have research students and still continues to be the only college in India from which students can qualify for a research degree in Engineering. The students of the college take particular interest in the University Officers Training Corps and they have the Engineering College Association for their extra-mural activities. During the past fifteen years, the college has trained over 2,000 engineers, 4,000 engineering subordinates and over 10,000 technicians.

*The Madras Medical College, Park Town*

This college was founded in 1835 as a medical school mainly to afford better means of instruction in Medicine and Surgery to Indo-British and Indian youths entering the medical branch of the service in this presidency. In the beginning there were only 10 medical apprentices and 11 Indian medical pupils and it was located in temporary rooms. In 1836 the school was shifted in a small building and it was conducting a course extending about two years. In 1846 the curriculum was expanded to over three years and five Professors were appointed for teaching purposes. In the year 1925, the University of Madras, abolished the L.M. & S. course and had only one initial degree—the M.B. & B.S. degree. At present besides the undergradute students studying for the M.B. & B.S. degree, several post-graduate studies for B.S.Sc., D.L.O., D.G.O., & D.O. examinations are also available. Further several post-graduate students avail themselves of the opportunity for studying in the Pathology and the Anatomy Museums of this college, the two museums being the best in India. The total staff of the college consists of 20 Professors, besides over 80 other teaching staff. The primary F.R.C.S. examination was conducted in the college in 1934 and in 1946.

Sir A. Lakshmanaswami Mudaliar was the first Indian Principal of

the Madras Medical College and the first Vice-Chancellor from the Medical profession.

*The Madras Law College, George Town*

The Madras Law College was opened in 1891 though it obtained a habitation of its own only in 1899 when it moved into the handsome building, designed by Henry Irwin, Esq., C.I.E., Government Architect, and erected to the west of the High, Small Cause, and City Civil Courts on the Esplanade, George Town.

The Law College prepares students for the F.L., B.L., and M.L. degree examinations. The B.L. degree supplemented by apprenticeship for one year in the Chambers of an advocate of the Madras High Court is, in general, the minimum qualification for entry into the legal profession in the Madras Presidency. The College has a well equipped library and affords excellent facilities for research work in law.

The students of the college have an elected Representative Council which is presided over by a student president and guides their extra-curricular activities. Moot Courts, debates, oratorical competitions and mock parliaments are conducted every year under the auspices of the Representative Council.

The Law College is a whole time institution with a permanent staff, the hours of each working day being between 10 a.m. and 4 p.m.

*Teacher's College, Saidapet*

The Madras Normal School established in 1856 in the city is the nucleus of the present Teacher's College, Saidapet. In the early years the school was imparting general education besides training for teaching work. In 1862 the subjects of study were changed so as to enable the students to prepare for the several University examinations but in 1872 the school restricted its activities only to profession training. In 1886 the name of the school was altered and it was affiliated to the University of Madras providing instruction to the L.T. degree. In 1887 the college was shifted to the present buildings in Saidapet. Till the opening of a separate institute for women, the Lady Wellingdon Training College in 1921, this institution was training both men and women. The college at present imparts education in different branches of B.T. degree, Secondary grade training, Manual training, and art-masters besides facilities are available for vocational training. The college has a high school, a kindergarten section, a nursery section, an adult school and a Pandits training section. The total capacity of students for the B.T. degree course is about 150.

*Lady Willingdon Training College, Triplicane*

This college was started in 1922, but its history can be traced further back to 1856, when the Madras Normal School was established for training teachers for their vocation. This institution was started in response to the need to train

a large number of women teachers and this college was developed from the first Hindu school for girls in Madras run by the Vijayanagaram trust in the later half of the last century and taken over by the Government of Madras in 1913 and extended into a training school for elementary and secondary grade teachers' training. In 1940, the college shifted to the new buildings. The college has three sections and imparts education for B.T. degree, secondary and elementary training. The college is also collaborating in conducting the M.E.D. degree course. The college has attached to it the Lady Willingdon High School (Model section) containing secondary and basic classes. The total staff of the college is 17.

*St. Christopher's Training College, Vepery*

St. Christopher's Training College, a Christian college for women teachers, was opened in 1923 with a class of eleven graduate students and one student who was not working for a degree. It has grown since that time not only by reason of the expansion in girls' education but through amalgamation on two occasions with other institutions. In 1928 it was amalgamated with Secondary Training Schools previously managed by a Scottish Mission and in 1935 with one of the oldest girls' schools in the city, the Bentinck Girls' High School (founded in 1832). Finally since 1944 St. Christopher's College has co-operated with the three other training colleges in Madras City in teaching for the M.Ed. degree in Education. There are now 175 students in the college and over 800 girls in the practising school.

*Meston Training College, Royapettah*

The Meston Training College was opened in 1937 and is maintained by British, American and Continental Missionary Societies. It grew out of a School founded by the Wesleyan Methodist Missionary Society in 1851; and the Wesley High School continues to be its chief Practising School.

Courses are offered for the Bachelor of Teaching Degree of the Madras University and also for the Master of Education Degree (in co-operation with the University and the other local Training Colleges). There are two Hostels attached to the College. Recently 'Basic Education' has been introduced as an Optional subject for the B.T. Degree Course.

*Madras Veterinary College, Vepery*

This College, which is one of the premier Veterinary Institutions in India, was started in October 1903 by Lieut. Col. W. D. Gunn, in a small rented building, mainly to train qualified personnel for the Civil Veterinary Department of this Province. The present College building, which is a fine piece of architecture was constructed in 1905 and further extensions to the main building, hospital and laboratories for different subjects were added. A separate building for the hostel was constructed in 1931 close to the College buildings.

Till 1936, the College was training students only for a course of 3 years followed by a Government Diploma-Graduate of the Madras Veterinary College. This course was later replaced by a Degree course of the Madras University. This College is the first Veterinary Institution in India to be affiliated to the University and conduct a Degree course—Bachelor of Veterinary Science of the Madras University, ever since 1936. The curriculum of studies of this course which was in the beginning extended over three and half years, was later altered in order to provide special training in Animal Husbandry, and the present Degree course extends over four years after the Intermediate Examination.

The College in the beginning admitted only 20 students, but later the number gradually rose to 50 and from 1947 the admissions have been increased to 100 students. Although most of the students are from Madras Province, people from different parts of India, as well as a few ex-army personnel are being trained in the College. This is the first Veterinary College in India to admit girl students and at present there are five girls undergoing the course. The present strength of the College is about 362 students.

Apart from this degree course, facilities are available in the College for Post-graduate Research work leading to higher degree, in different branches of Veterinary Science and Animal Husbandry. So far three students have taken M.Sc. Degree from this College.

Besides teaching work, the College serves as the Central Laboratories for the entire Province and materials received from the District staff of the Animal Husbandry Department are being examined in the College by the concerned departments. Although no whole time research work could be contemplated, substantial research contributions have been made in the past by the Departments of Parasitology, Bacteriology, Pathology and Anatomy.

There is a separate Veterinary Hospital attached to the College for the treatment of all kinds of domesticated animals which serves for clinical practice to the students.

The College staff consists besides the Principal, eleven Gazetted Lecturers, 16 Assistant Lecturers, and 4 Demonstrators.

Thus from a humble beginning in 1903, this College developed into a first rate Veterinary Institution in India, and the students trained from the alma mater have earned name and fame not only in different parts of India but also in other countries.

Ripon Buildings, Park Town

Law College, Esplanade

Government Arts College, Mount Road

# LIBRARIES IN MADRAS

BY

R. JANARDHANAM NAIDU

*Librarian, Connemara Public Library.*

There are at present a fairly large number of libraries in Madras to serve the needs of its residents though indeed attempts will have to be strenuously made for increasing this number. A knowledge of the materials available in these libraries and the facilities afforded by them would naturally prove to be of great value to the citizens of Madras and this Presidency, and the following is a brief account concerning them.

The Government of Madras is maintaining the Connemara Public Library, situated within the Museum compound at Egmore, for the benefit of the residents of Madras and its vicinity and also for the whole of this Presidency. It was opened in the year 1896 as a free consulting Library but from the beginning of 1930 it has also been lending books to the residents of the city and its immediate neighbourhood and to well organized libraries in the mofussil districts that apply for affiliation to this library to borrow books from it. Those who wish to consult books in the library are allowed to do so, provided they are over seventeen years old and are willing to abide by certain rules such as, that they will not cause damage to the books used by them or disturbance to any reading in the library.

Those who wish to become borrowing members will, besides satisfying the condition of age have to be guaranteed by one of the following viz., Principal or Professor of a college, a Corporation Councillor, an honorary Presidency Magistrate, or a Government Gazetted officer, and will also have to remit a deposit of rupees twenty each. Every member is allowed to borrow 3 books at a time which he can retain for a period of a fortnight and can renew them for a further period provided no other member applies for the same. No subscription is charged, but if a member loses a book he will have to replace it forthwith. That will be returned when he ceases to borrow, on receipt of an application for it.

The library contains books on all subjects, literature, histories, and sciences. In addition the library subscribes for a large number of literary, historical and scientific periodicals, and for most of them book numbers are available from very early years. Books are being constantly added to the library generally selecting those of permanent value and also those in demand by the public.

The library practises the open access system, that is, any visitor can directly go either to the catalogue cabinet or to the book shelves to select a book or books for himself. He can go through the books

at the shelf and select those that he considers will be of much value to him. In the course of his regular study in the library, if he needs some other books for reference, he can forthwith go to the shelf and pick them up for himself. If he finds any difficulty in doing so, the library staff will render him the necessary help. The periodicals that arrive week after week or every fortnight or month are assembled on the tables and are directly accessible to the public.

There is also a portion of the library set apart for research workers where all facilities needed for research workers are most willingly given by the members of the staff. This section of the library is found most useful to those who wish to prepare theses or lectures or write books.

The library is open on all days in the year including public holidays, except on Fridays, between 8 a.m. and 5-30 p.m. By constant care and supervision a congenial atmosphere for study is maintained in the Library Reading Hall.

When the Madras Public Libraries Act 1948 comes into force, the Connemara Public Library will become the Government Central Library for the Province, and according to the recently amended Press and Registration of Books Act 1867, five copies of each of the books printed and published in the Province will then have to be sent to the Library. As a Central Library it will lend books to all libraries in the Province that will be administered according to the provisions of the Madras Public Libraries Act, 1948.

The Madras University Library which is maintained by the University of Madras with the help of a substantial grant from the Government of Madras is situated at Chepauk within the University buildings. It was opened in the year 1914 and is rapidly growing in size and is open on all days in the year between 7 a.m. and 5-30 p.m. from October to March and between 7 a.m. and 6 p.m. for the rest of the year. It restricts admission to those who are students in the colleges affiliated to the University of Madras and to those who are graduates of the University of Madras. Only students of senior status reading in the affiliated colleges and graduates of the University can borrow books from it provided they are recommended by the principal or a professor of a college or by the authorities of the University, and also deposit a sum of Rs. 20 each. No subscription is charged and the terms for the loan of books are similar to those of the Connemara Public Library. There is a good collection of standard works and periodicals in this Library which the students and graduates of the University can make the best use of. Graduates of the University from the mofussil stations can also borrow books from this Library, if they satisfy the conditions laid down.

The Government Oriental Manuscript Library is located in the University Library buildings, Chepauk. It was opened in the year

1847 and contains numerous manuscripts in Indian languages and also printed books. It is primarily a free consulting Library but also lends books and manuscripts on special conditions. There is an exceedingly valuable collection of manuscripts in this library most useful to research workers and scholars. It is open on all days in the year except on Fridays and on public holidays between 11 a.m. and 5 p.m.

Adyar Library opened in the year 1886 is situated within the Theosophical Society buildings at Adyar and is a free consulting library. It contains books and periodicals besides valuable manuscripts. It is open between 7-30 a.m. and 5-30 p.m. and has only 15 annual holidays. Books also can be taken on loan by furnishing cash securities.

Ranade Library at Mylapore is again a free consulting library but books can be borrowed only by subscribing members. It is maintained from the proceeds of an endowment and has a fine collection of books.

Corporation of Madras maintains a library, which is located in a part of the Ripon Buildings, called Sunkuwar Municipal Library. It contains mainly books on civics and is open to public only for consultation. It works on all days in the year between 11 a.m. and 5 p.m. except on Sundays and public holidays.

The Registrar of Books has a very large collection of books printed within this presidency in different languages from the year 1870 and they are kept in a portion of the office of the Director of Public Instruction, Nungambakkam. They are not freely accessible to the public, but if any citizen of Madras or this presidency wishes to consult any of the books, he can do so by obtaining the permission of the Registrar which is usually given. On special conditions loan of books can also be had from the Registrar. The office of the Registrar is open on all days in the year, except on Sundays and on public holidays between 11 a.m. and 5 p.m.

Among the subscription Libraries, The Madras Literary Society founded in the year 1812 ranks the foremost. It is at Nungambakkam and has an excellent collection of books in fiction. It is open on every week day from 7 a.m. to 7 p.m. (except Wednesdays) and on Sundays and holidays between 8 a.m. and 12 noon. Resident members pay a quarterly subscription of Rs. 10 or a monthly subscription of Rs. 4. Non-resident members pay Rs. 10 quarterly besides the carriage charges for books supplied to them.

Among the recent institutions, mention may be made of the Young Men's Christian Association and Young Men's Indian Association which have their own libraries and they are open to members of the respective associations for consultation and loan.

# THE KING INSTITUTE OF PREVENTIVE MEDICINE

BY

M. K. K. MENON

*Director, The King Institute.*

The King Institute of Preventive Medicine is located in Guindy amidst picturesque surroundings about 8 miles away from Fort St. George, in Madras. It is named after the late Colonel W. G. King, C.I.E., I.M.S., who as the Sanitary Commissioner to the Government of Madras was primarily responsible for its inception. This Institute was opened by His Excellency Lord Ampthill, Governor of Madras in 1905. Though the Institute was originally designed to serve as a Lymph Depot to supply vaccine Lymph for the whole Province, its activities have, however, expanded considerably since that time. This Institute now constitutes the main centre of medical and public health research in this Province. Its main activities include (1) the functions of a general Bacteriological Laboratory for all the hospitals of this Province in providing for serological, bacteriological and clinical examination of specimens submitted. (2) Manufacture, storage and distribution of Biological Products like sera, lymph vaccine and bacterial vaccines. (3) Chief Public Health Laboratory Centre for the analysis of Water, Foods and Drugs.

The staff of the Institute consists of a Director, 4 Assistant Directors, a Government Analyst for foods and drugs and a Chief Water Analyst. They are assisted by a number of medical and non-medical Gazetted and subordinate officers. The Institute is maintained by the Provincial Government and functions under the administrative control of the Surgeon-General with the Government of Madras and works in close co-operation with the Director of Public Health and the Public Works Department of the Government of Madras.

The varied activities of this institute are given briefly in the following paragraphs.

1. *Vaccine Lymph Section*: This engages itself in the manufacture of vaccine lymph for protection against smallpox. After the usual tests for purity, potency and freedom from toxicity, glycerinated lymph is issued to the vaccination staff of the Public Health Department of this Province. Supplies are also made to the Military, the Railway and the Emigration authorities as also to the adjacent French territories and Indian States.

2. *Diagnostic Section*: This section deals with all the clinical materials sent to it by various medical institutions in the Province and private medical practitioners. In 1948 nearly 10,000 specimens were

received for microscopical and bacteriological diagnosis and nearly 150 specimens for histopathological examination. The number of Kahn and Wassermann tests totalled to about 80,000. This section prepares several reagents used in these tests and also supplies some of these reagents to outside institutions.

3. *Bacterial Vaccines*: These vaccines intended for therapeutic and prophylactic use are manufactured in the Institute. During 1948 nearly 9 million ccs. of cholera vaccine were manufactured. Plague vaccine continued to be received from the Haffkine Institute, Bombay and distributed to the Public Health Personnel in the Province. Autogenous vaccines, typhoid and paratyphoid vaccines, filarial and gonococcal vaccines continued to be manufactured and issued from the Institute to the various Provincial Hospitals and Municipalities. Various diagnostic agglutinating sera as well as formalised bacterial suspensions for agglutinating tests are also manufactured and issued to the respective indentors.

4. *Sterile Solutions*: There is a continually increasing demand for sterile solutions from the several hospitals in the Province and it has not always been possible to meet all the demands.

5. *Antitoxins Department*: This Department is concerned with the manufacture and standardisation of certain Therapeutic sera such as Tetanus Antitoxin and Gas gangrene Antitoxins. Of recent years there has been an increasing demand for the supply of these sera. The Department possesses 37 horses at the present moment and it is proposed to increase the number of horses with a view to increasing the production of sera.

6. *Department of Water Analysis and Algae Control*: The main work of this section relates to the collection and examination of samples of water from all the protected water supplies in this Province to see if they conform to the standards of purity as regards bacteriological and chemical quality. There was a steady increase in the total number of samples examined from the Municipal water supplies of the Province. Water samples from Railway station platforms are also periodically examined to see if they fall short of the required standards. It is also proposed to make a survey of the mineral and medicinal springs in the Province. Field investigations are also conducted in various districts of the Province relating to problems of water supply, sewage treatment and algal control.

The supply of Protein Hydrolysate to the city and mofussil hospitals, a new activity initiated in 1946. with a view to meet the situation created by a threatened famine in the Province, is being continued. Research work on "Milk Bacteriology" is also undertaken relating to the study of the changes that occur in the bacterial

flora of milk stored at different periods of time after collection at atmospheric temperature.

7. *Blood Bank*: The King Institute forms the centre of the blood transfusion service in this Province. Started as a war time activity it is now being very usefully continued during peace time. Plasma is processed in the Institute and issued to hospitals and private practitioners. In addition, supplies are made of dry serum, group serum, transfusion sets and other necessary materials for starting blood banks in various other places. The King Institute blood bank mobile unit is visiting various places for collecting blood from voluntary donors.

8. *Department of Biologicals Control*: In order to control the purity, potency and safety of the biological products manufactured in the Institute, a separate department of biologicals control has been established to provide an additional check on these products. This department also serves as the Government Analyst's Laboratory for biologicals and special drugs in connection with the working of the Drugs Act.

9. *Government Analyst Department*: This laboratory deals with the analysis of samples of food taken under the Prevention of Adulteration Act throughout the Province. This Laboratory also checks the purity of foods and drugs supplied to Government hospitals in the Province. Samples are taken in the municiplities by sanitary inspectors working under the direction of the local Health Officer or other executive officer. The samples are then sent to the Institute where they are examined by the Government Analyst and his staff.

10. *B.C.G. Laboratory*: B.C.G. vaccine for use in the Anti-tuberculosis campaign is now being manufactured in the Institute under the control of the Director General of Health Services.

In addition to the different types of routine work detailed above, the Institute has a good record of original research work on many medical and public health subjects. During recent years research activities have been extended considerably owing to the generous financial assistance given by the Indian Research Fund Association. Researches are now being chiefly undertaken on problems with virus diseases, cholera and filariasis.

# THE MADRAS MUSEUM

BY

A. Aiyappan, M.A., Ph.D., F.R.A.I.,
*Superintendent, Government Museum*

The Madras Government Museum, one of the best of its kind in India, is situated on the Pantheon Road in an extensive compound of shady trees. The Museum consists of two fine buildings and an extension. The Museum Theatre forms part of the front building and to its rear is the Connemara Public Library. In this front building are exhibited the prehistoric antiquities and the arms and weapons on the ground floor and the bronze images and ethnographic collections on the first floor.

The new extension leads on to the rear building. In this part the visitor sees the stone sculptures beginning from the ancient bronze age of Mohenjo Daro leading through the main phases of Indian History. The architectures and sculptures of these periods—Jain, Buddhist and Hindu show the pervasive symbolism of religious art in India. The evolution of the several South Indian scripts is also depicted here in inscriptions and charts. The History of India through coins is yet another interesting and instructive exhibit.

First there is a chronological sequence of South Indian Sculptures—Pallava, Chola, Vijayanagar leading on to the modern period. The next section is devoted mainly to sculptures depicting the deities of the Hindu Pantheon and the third section exhibits the Buddhist sculptures from the Amaravati stupa of which there is also a plaster model. In the other section are the Jain images chiefly the Tirtankaras.

A small collection of paintings typical of South Indian art is exhibited at the beginning of the Natural History Galleries. On the ground floor are the skeletons among which is the huge whale skeleton, reptiles, birds and mammals and adjoining this are the newly reorganised Geology Galleries. On the first floor are the corals, shell-fish, insects and fishes on one side and the Botanical section on the other including economic and medicinal plant products and plants of systematic importance.

In the front building, which houses the Museum theatre in front and the Connemara Public Library in the rear, are varied exhibits. On the right wing of the ground floor are exhibited the large collections of prehistoric antiquities. These include stone tools of the old and new stone ages, huge pottery urns and coffins, iron tools, beads and bronze vessels mostly obtained from very ancient burials. In the left wing are guns, cannon, mortars and grape shot obtained as trophies of the East India

Company and the swords, daggers, spears, and elephant goads from the Tanjore armoury.

On the first floor of this building are the ethnographic collections such as bows and arrows, boomerangs and blow guns, firemaking appliances, models of dwellings and objects of the material culture of the South Indian hill tribes, a large collection of South Indian musical instruments and peasant jewellery.

The world famous bronze images of South India of which the dancing Sivas or Natarajas are some of the finest pieces of art are exhibited here along with other remarkable Saivite, Vaishnavite and Buddhist images. On the same first floor on the opposite section are exhibited a large number of exquisite wood carvings, objects of ivory work and a varied collection of metal ware objects.

The Madras Museum is one of the best civic amenities where the visitor is made conscious of the immense cultural heritage of this country.

Madras Egmore Station

Madras Central Station

# THE RAILWAYS OF MADRAS

BY

R. GOPALAKRISHNAN, M.A.,

*Public Relations Officer, M. & S. M. & S. I. Railways*

The City of Madras is served by the two principal Railway systems of Southern India, viz., the Madras & Southern Mahratta Railway and the South Indian Railway. The former has its administrative headquarters in the City while that of the latter is situated at Trichinopoly, a flourishing town about 200 miles from the metropolis. Between them these two railway systems have a route mileage of 5,300 nearly a third of which is broad gauge and the rest metre gauge. The M. & S. M. Railway has three principal broad gauge lines radiating from Madras, in the North-Easterly, North-Westerly and South-Westerly directions. The first of these runs along the Coromandel Coast for a distance of 485 miles up to Waltair where it connects with the Bengal-Nagpur Railway's main line to Calcutta. The North-West line runs for a distance of 350 miles to Raichur where it joins the Great Indian Peninsula Railway's main line to Bombay. The South-West line connects Madras with the City of Bangalore, which is the junction of the Mysore State Railway. From Jalarpet junction situated at a distance of 133 miles on the Madras-Bangalore line, the South Indian Railway's broad gauge system takes off, connecting the western ports of Cochin and Mangalore on the Malabar coast.

The South Indian Railway has a large metre gauge system which commences from Madras Beach (which is a junction with the broad gauge system of the M. & S. M. Railway) and the main routes leading to Dhanushkodi, Tuticorin and Trivandrum. Besides many branch lines and chords, there is a close net-work of railway serving the fertile and populous delta of the Cauvery.

The principal passenger station of the M. & S. M. Railway is aptly called Madras Central, situated as it is in the heart of the City. The station building, originally built in 1873 was considerably remodelled in recent years. The station is a terminus for all broad gauge trains of the M. & S. M. and S. I. Railways. It is provided with several covered platforms, a large and well-lit circulating area, well-equipped waiting and retiring rooms and restaurants. Adjacent to the Central Station is an imposing building constructed in the Dravidian style of architecture with facades in Porbunder stone and in this building are housed the administrative offices of the M. & S. M. Railway.

The main goods depots of the M. & S. M. Railway in the Madras area are at Salt Cotaurs and Rayapuram and are busy centres of freight traffic. The principal marshalling yard of this Railway has been constructed at Tondiarpet. All freight trains to and from the Madras area are

broken up or marshalled, as the case may be, in this yard. Breaking up of goods trains is done by an engine pushing the train over a 20 feet bump and the wagons rolling by gravity to the respective sidings. The points controlling these sidings are electrically operated.

The S. I. Railway's chief passenger station in Madras is Egmore which is a busy residential locality of the City. The station building and surroundings have been considerably modernised of late and passengers are given necessary amenities in the nature of restaurants, well-furnished rest and waiting rooms. Main line trains on the metre gauge commence or terminate their journeys at Egmore. A length of 18 miles of railway from Madras Beach to Tambaram has been electrified this being the only metre gauge electrified section in India. A fast and frequent train service is maintained over the section and it is exceedingly popular with officials, students and businessmen living in the residential areas of Saidapet, Mambalam, Chetput and Egmore. The expansion of the City along this line has been stimulated by the electrification of this section.

In the region served by the M. & S. M. and S. I. Railways, places of interest for different classes of travellers are in legion. Southern India, as is well-known, is studded with temples, palaces, monuments and shrines of great antiquity, whose artistic and architectural beauty has been extolled by eminent authorities. The S. I Railway has been correctly described as the "Pilgrim Line", traversing as it does a country reminiscent of its historical and religious associations. The ruins of the historic empire of Vijayanagar are very near Hospet station on the M. & S. M. Railway. There are innumerable places on both the Railways which are well worth visiting for their historical, educational, commercial and industrial importance.

During the war years, Railways in the South were, along with other Indian Railways, called upon to shoulder a great responsibility in moving abnormally heavy military traffic. It is a well-known fact that railways rose to the occasion in a splendid manner, thereby contributing in no small measure to the successful conduct of operations in the various theatres of war. Unfortunately, there is also a sordid side to the picture. Maintenance, repairs and renewals of equipment and permanent way suffered considerably owing to shortage of materials and the pressure of traffic. Even after the termination of hostilities, Railways have not been able to recoup their pre-war standards. Owing to the all round shortage of food and allied causes, railways are once again carrying enormous traffic, this time in foodstuffs, fuel, essential commodities particularly to feed the industries. Further the non-availability of materials has also been responsible for the slowness of the pace of rehabilitation of the railways. A concerted drive to make the best possible use of the transport system of the country, and to contribute to the improvement of its equipment and operation is urgently called for.

A glance at the history of the Railways in India will impress even the most casual observer with the phenomenal growth of the system and the enormous financial interest which the Government have in this undertaking. It was in 1854 that the first section of railway in India was opened between Howrah and Raniganj. In 1856 the railway made its first appearance in South India with the opening of the Madras (Rayapuram)—Arcot (now called Walajah Road) section. By the year 1900, the mileage of railways in India totalled 25,000 and a sum of Rs. 330 crores had been spent on their construction. Today the Railways of India sprawl 34,000 miles and the total capital at charge is computed to be Rs. 750 crores. Their gross revenue in a year is nearly Rs. 184 crores. They carry over a thousand million passengers and seventy million tons of freight in a year. The two railway systems with which we in South India are intimately concerned have a capital outlay of over 100 crores and their annual gross earnings are to the tune of 36 crores. Nearly 250 million passengers and 14 million tons of freight are carried by these Railways in a year. These figures may give the reader some idea of the magnitude of the undertaking which is intimately associated with the general welfare of the country at large.

# ROAD PASSENGER TRANSPORT IN MADRAS CITY

BY

P. C. MATHEW, I.C.S.,
*Deputy Transport Commissioner.*

Madras City has a population of approximately 11 lakhs spread over nearly 50 sq. miles including about 20 sq. miles added by way of recent extensions. Less than 10% of the population use private conveyances. The remaining 90%, i.e., nearly 10 lakhs of people either walk or use public conveyances more especially electric trains, trams and buses whenever they have occasion to move about in the City on business or for pleasure. The suburban Electric Train Service covers about ten miles of track in the City. The Electric Tramways have nine miles of double track and seven miles of single track over which about 90 tramcars operate. The tram tracks are of course laid along the roads of which there are over 400 miles in the City. The electric wires that were first laid underground were frequently damaged during heavy rains and therefore had to be replaced by a net-work of overhead wires stretching over the entire tramway track. The City's first fleet of motor buses were also tried in 1925 by the Company which owns the Tramways; but they had to close down the bus section in less than 4 years as buses could not operate at the same level of fares as trams. Since then other private concerns took up bus transport and the bus services gradually developed with the population. In 1947 there were 194 buses licensed to operate on 17 routes in the City.

In 1947, the Government of Madras decided to nationalise bus transport in Madras City. As no satisfactory settlement could be reached with the private operators for the purchase of their buses and workshops, the Government started building their own buses and setting up their own new workshops and depots. By July 1948 they replaced the entire private fleet in the City. As against 194 private buses on 17 routes, the Government Transport operates 232 buses most of them with 40% larger capacity, on 37 routes in the City. The private buses now seen in the city are those operating from the City to places outside.

The Tramways are operated by a British Company under a licence granted by the Provincial Government. The licence provides that the Corporation of Madras can compulsorily acquire the concern on certain financial terms in 1955 when the present period expires. This of course does not preclude the possibility of purchase by mutual negotiations and in fact the Corporation and the Government of Madras seriously considered the idea of purchase some years ago but finally

| Route No. | Course of Route |
|---|---|
| 1 | TRIPLICANE—PARRYS *via* Mount Road, Central. |
| 2 | TRIPLICANE—MINT *via* Mount Road, Central, Elephant Gate, Basin Bridge. |
| 2A | MOUNT ROAD—MINT (Shuttle). |
| 3 | MYLAPORE—PARRYS *via* Royapettah, Mount Road, Central. |
| 3D | MYLAPORE—PARRYS *via* Abiramapuram. |
| 4 | MYLAPORE—TONDIARPET *via* Parrys, Royapuram Police Stn. |
| 4A | MOUNT ROAD—TONDIARPET *via* Parrys, Mada Church Road. |
| 5 | ADYAR—PARRYS *via* Adyar Bridge Road and then along route 3. |
| 5A | ADYAR—MYLAPORE (Shuttle). |
| 6 | M. U. C.—TONDIARPET *via* Royapuram Police Station. |
| 6A | M. U. C.—TONDIARPET *via* Monegar Choultry Road. |
| 7 | PARRYS—PERAMBUR *via* Central, Periamet, Doveton, Strahans Road, Cooks Road. |
| 7A | PARRYS—PERAMBUR *via* Doveton, Purasawalkam, Kellys. |
| 7B | PARRYS—VILLIWAKKAM *via* Aynavaram. |
| 8 | PARRYS—PERAMBUR *via* Mint, Basin Bridge. |
| 8A | MINT—PERAMBUR (Shuttle). |
| 9 | PARRYS—T. NAGAR *via* Central, Egmore Railway Station, Nungambakkam. |
| 10 | PARRYS—T. NAGAR *via* Central, Museum, Nungambakkam. |
| 11 | PARRYS—T. NAGAR *via* Mount Road. |
| 12 | TRIPLICANE—T. NAGAR *via* Luz. |
| 12A | MYLAPORE—T. NAGAR (Shuttle). |
| 13 | TRIPLICANE—T. NAGAR *via* Royapettah. |
| 14 | MINT—KELLYS *via* Elephant Gate, Choolai. |
| 15 | PARRYS—AMINJIKARAI *via* Central. |
| 16 | MOUNT ROAD—KELLYS *via* Egmore Railway Station. |
| 17 | PARRYS—NUNGAMBAKKAM *via* Central, Egmore Railway Stn. |
| 18 | PARRYS—SAIDAPET *via* Mount Road. |
| 19 | BROADWAY—LATTICE BRIDGE *via* Saidapet, Adyar. |
| 20 | BROADWAY—VILLIWAKKAM *via* Egmore Tram Shed, Purasawalkam, Kellys, Aynavaram. |
| 21 | PARRYS—MANDAVALLI *via* Royapettah High Road. |
| 21A | PARRYS—MANDAVALLI *via* Barber's Bridge, Marina. |
| 21B | PARRYS—MANDAVALLI *via* San Thome. |
| 22 | TRIPLICANE—KELLYS *via* Egmore Over Bridge. |
| 23 | MYLAPORE—EGMORE RAILWAY STATION *via* Commander-in-chief Road. |
| 23A | MYLAPORE—EGMORE RAILWAY STATION *via* Nungambakkam High Road. |
| 24 | AMINJIKARAI—O. M. C. *via* Peter's Road. |

| Route No. | Course of Route |
|---|---|
| 52 | PARRYS—PALLAVARAM *via* Saidapet, St. Thomas Mount, Meenambakkam. |
| 53 | BROADWAY—POONAMALLEE *via* Aminjikarai. |
| 56 | MINT—TIRUVOTTIYUR *via* Washermanpet. |
| 57 | MINT—RED HILLS *via* Vyasarpady. |

## SPECIALS

### MADRAS TO TIRUPATHI DAILY SERVICES

ROUTE 101—MINT TO TIRUPATHI *via* Tada, Kalahasti.
From Mint at 5-30 and 11-30 hours.
From Tirupathi at 6 and 13 hours.

ROUTE 102—BROADWAY TO TIRUPATHI *via* Tiruvallur, Tiruthani, Puttur.
From Broadway at 6 and 12-30 hours.
From Tirupathi at 6-30 and 13-30 hours.

ROUTE 104—MINT TO TIRUPATHI *via* Nagalapuram, Puttur.
From Mint at 7-30 and 13 hours.
From Tirupathi at 7 and 14-30 hours.

### MAHABALIPURAM EXCURSION SPECIAL

On every Sunday at 8 A.M. starting opposite to Y.M.C.A., Esplanade.
*(For details please see page 35 of the City Bus Guide)*

## YOUR ATTENTION PLEASE

1. Please tender the correct change, obtain a ticket and retain it till the end of the journey.
2. Please help to minimise inconvenience during peak hours by queueing up at the stops.
3. While leaving the bus, make sure that you do not leave any of your property behind ; in case you have lost any thing please contact the Traffic Manager, for assistance.
4. Bulky, heavy or objectionable articles will not be carried in the bus.
5. For hire of special buses for parties and seat reservation in our mofussil services *Apply to the Transport Officer.*
6. Please get into buses and get down from buses quickly; it will help to keep the buses moving.
7. Please avoid peak hours; if you can, put off your trips to the other hours when there is ample room in all buses.
8. It would be a graceful act of courtesy on the part of a man to give up his seat in the bus in favour of a woman or a weak or aged person who could otherwise have to remain standing.

*Enquiries and Complaints :* TRANSPORT OFFICER, 'TRANSPORT HOUSE'

dropped the proposal as it was felt that the price fixed by the Tramways was too high considering the age and condition of the stock. The fact that trams would have to be completely replaced before many years as they are fast getting out-moded with changes in people's ideas of comfort, noise and speed. There is however no doubt that it requires considerable expenditure to scrap them at the present moment and to replace them with new motor buses or trolley buses as they are being done in several cities in the west. The tramways will therefore have to continue for several years with whatever improvements possible and meanwhile the public can have the benefit of cheaper if not a faster and comfortable means of transport. Unified ownership and operation of buses and trams would probably enable the administration to deploy the combined transport resources more economically and advantageously to the public and from this point of view the purchase of the tramways by Government by negotiation seems to be highly desirable. But any such advantage may be more than offset by increased severity of public criticism as experience shows that the public are much more exacting and intolerant in their demands on public-owned concerns of which they are shareholders and customers than on private concerns of which they are only customers.

Government Transport maintains detailed records showing the number of tickets of different denominations issued on each day and each bus, the number of tickets issued at each time and place. In fact if any ticket issued is produced at random on any subsequent date, it would be possible to say with the help of these records the date and time at which it was issued, the number of the bus and the name of the conductor, the stage where the passenger boarded the bus and the stage where he got down from the bus. The total number of miles performed daily by the Government Transport fleet is approximately 30,000 miles which is more than the distance round the earth. About 2 lakhs of passengers are carried everyday, but this number varies from day to day. Apart from random variations on account of unpredictable causes such as the weather, there is distinctly more traffic at the beginning of a month and this trend tapers off towards the end of the month. There is also a weekly cycle which seems to show a partiality for Mondaya, Tuesdays and Fridays. The collections also tend to rise in December-January, which is the gala season in Madras. All these and similar trends and fluctuations have to be studied and the traffic facilities adjusted so as to suit the seasonal requirements.

The traffic records and observations disclose other interesting features also. There is more traffic in the afternoon than in the morning presumably because all for pleasure trips are reserved for the evenings. There is surprisingly little travel after 8 p.m. in South Madras and in fact the collection after 8 p.m. on most routes is far

short of the cost of operating the buses after 8 p.m. It is possible however that continued provision of good travel facilities at night may create more late evening traffic, but the present petrol shortage makes any such experiment impossible. After maintaining the full service till about 8 p.m. the bus service is at present tapered off towards 10 p.m., the angle of the taper depending on the immediate petrol situation. The average Madrasi seems to be generally in favour of spending his holiday at home instead of going out in parties on picnic or sight-seeing expeditions. There is a distinct fall in the revenue on holidays, showing that the additional pleasure traffic is less than the business traffic lost on account of the holiday. There are several reasons for this, such as the lack of sufficiently cheap facilities to suit his lean purse and the fact that in many parts of Madras city, residences are not so closely packed as in other cities. One or two experiments have been tried by Government Transport to entice him on holidays to places of beauty or pilgrimage such as Mahabalipuram and Tirupati, but here again there are practical difficulties which restrict the immediate extension of such facilities. Another notable feature is the increasing number of women passengers of all classes. This may be partly due to the increasing restrictions on private motoring in the form of drastic petrol cuts, but it is also due in a great measure to the improving quality and comfort of the service offered and in particular the greater courtesy shown by the traffic staff and the passengers.

Madras Province generally appears at the top or bottom of every list. In fact she appears so even on the geographical map of India, the position depending on which way one hangs the map. As regards motor transport the motor vehicle taxation in Madras is the highest in India, but the bus fares are the lowest not only in the mofussil, but also in the city in spite of the fact that the city fleet was purchased and equipped only after prices had reached their peak. In comparing Madras Transport with transport in other cities one other natural factor should also be borne in mind. Bombay and Calcutta have populations of about 27 lakhs and 29 lakhs spread over 26 sq. miles and 42 sq. miles respectively, the average density being 104,000 and 69,000 per sq. mile as against less than 22,000 per sq. mile in Madras. However gratifying this may be for Madras, from the public health point of view this means that a higher "occupation ratio" or "load factor" (i.e., ratio of passenger miles to seat miles) can be expected in Bombay or Calcutta than in Madras. The fare to be charged in order to cover a given expenditure on operation varies inversely as the load factor and therefore other conditions being equal it would be possible to operate a transport service in a denser city at a lower level of fares. In fact, the Madras City Bus Service is operating at a very low margin of profit; out of every anna collected from a passenger, $3\frac{1}{2}$ pies is spent

on petrol, 2 pies on depreciation, 2 pies on wages of traffic crew, 2 pies on mechanical maintenance including mechanical staff, one pie on motor vehicles tax and half pie on officers establishment and contingencies, leaving hardly one pie for net revenue on the investment made. Even this slender margin of revenue is being encroached upon by increasing prices. It remains to be seen how far economy in staff and materials can withstand increasing cost on account of rising prices.

The large variety of tickets sold on the city buses and trams cause avoidable waste of effort both by the crew and by passengers. The average value of a bus ticket is about two annas; the minimum fare is one anna and the maximum is only 4 annas in spite of the fact that some routes even within the city are as long as 10 miles. It would be very desirable to introduce a single value ticket of say 2 annas or $2\frac{1}{2}$ annas just like a postage stamp. Such an arrangement or a similar arrangement involving two kinds of tickets is working very well in American Cities where they have been able to dispense entirely with conductors by these means, but it is practically certain that this will reduce the revenue considerably in Madras City. The long distance customers—who even now have a preference for buses in view of the greater speed of buses compared to competing forms of transport and the telescopic fare structure—will pay less, but the short distance passengers who it is assumed will pay more will actually migrate to other forms of transport which will then be much cheaper for short distance travel. The question cannot therefore be considered till a single agency controls all the major items of passenger transport in the city; in fact even the Post office cannot work on their present single rate if local concerns are allowed to compete with them in smaller areas at lower rates as they will be left with only the long distance letters and parcels to carry.

In spite of the various difficulties that have to be encountered in providing adequate transport facilities to a growing population, the Government of Madras has been able to solve this problem so far in a satisfactory manner. Still a long way has to be covered before having a good system of public transport with comfortable seats and adequate number of buses; but the present public transport in the Madras City compares very favourably with similar facilities in any of the large cities of India.

# MINERAL RESOURCES OF THE MADRAS PROVINCE

BY

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In this note, mineral resources of Madras are briefly sketched under the two broad divisions namely Metallic Mineral Deposits and Non-metallic Mineral Deposits.

## METALLIC MINERAL DEPOSITS

*Iron and Ferro-alloy metals*

*Manganese,* iron and chromium ores occur in abundance in the order mentioned. Next to Russia, India is the largest producer of manganese which is a vital ore for the manufacture of steel. Deposits of manganese ore are worked at Kodur, Garividi, Garbham in the Vishakapatnam district and in Sandur. The ores from Vishak are of second grade quality, while those of Sandur have a high iron content. It is reported that there are considerable reserves in the Kammadheruvu and Kumaraswamy areas in Sandur and this area contributed 16,415 tons for which the f.o.b. value at Indian port was £14,363 sterling in 1946. With the expected increase in the export of manganese ores, in the immediate future, the output from the province is likely to be also on the increase.

*Iron*: Magnetite ores occur in Salem, Tiruchirapalli, South Arcot, Kurnool districts and Sandur. The Salem reserves approximately amount to 300,000,000 tons, with an iron content of about 35 to 40 per cent. Hematite deposits have been located near Veldurthi and Ramallakota in the Kurnool district and analysis have indicated 50 to 60 per cent of iron in them. Sandur ores have also proved to be of high grade hematites.

*Chromium*: Chromite, the output of which was 274 tons at an estimated value of Rs. 6,850 in 1946, is chiefly confined to deposits of Kondapalli hills in the Krishna district. Although there is a general indication that there are several thousand tons available detailed prospecting is necessary in this area. Refractory grade chromite, containing about 35% chromic oxide occurs in the Tiruchengode taluk of Salem where the reserves within 20 feet are of the order of 2 lakhs of tons.

*Tungsten*: Though wolframite with 31.27 per cent of tungsten and 3.1 per cent of tin is being obtained in very small quantities from Kadavur, Tiruchirapalli district, these reserves are negligible.

*Non-Ferrous metals*

*Aluminium*: The bauxite deposits in Madras Province has a reserve of high grade bauxite of two million tons out of 250 million tons in India. The Shevaroy Hills of Salem, contain in addition to good quality metal 4-5 million tons of lower grade.

*Copper*: The only deposit worth mentioning is that of Garimenpenta in the Nellore district. The area was geophysically explored by a German firm, which indicated that ore beds may be found at depths down to 200 feet. Copper ores have also been reported to occur in Agnigundala in Guntur and in Gani in the Kurnool district. These reported deposits are expected to be fruitful.

*Lead*: Lead ores are known to occur at Nagasamipalle and Kotlur in the Cuddappah district, Chityala and Koilkuntla in the Kurnool district and also at Karampudi in the Guntur district. There is no information about the extent or workability of these occurrences.

*Minor Metals*

*Magnesium*: Large deposits of magnesite occur in the well-known chalk hills of Salem and these reserves are about 80 million tons for a depth of 100 feet and occurs in the form of veins and pockets in serpentinized rocks. Salem produced 43,246 tons of value Rs. 562,537 in 1946.

*Beryllium*: Beryl, the source of beryllium occurs in the pegmatites of Nellore. This new metal has been found to be of remarkable use as an alloying element with copper and is useful in making various types of springs, particularly useful in air-plane industry. Beryllium is also used in x-ray tubes, fluorescent lamps and neon signs.

*Titanium*: Ilmenite sands occur in the Chow-Ghat-Ponnani Coast, between Puthiya-Kadapuram and Ponnani. The best deposit is located at Manatalu about 16 miles from Trichur and good deposits are found near the mouths of the Vaipar and Kallar rivers in the Tirunelveli district, and near Tranquebar in the Tanjore district. The Kallar occurrence is about 14 miles north of Tuticorin.

*Zirconium*: Zircon and monazite are found associated with the ilmenite sands, making about 5 per cent and 2 per cent respectively.

*Precious Metals*

*Gold*: Alluvial gold has been obtained in the Wyanad region of the Nilgiri district. The tenor of the gold is rather low, though occasionally rich pockets and patches have been found. Auriferous quartz veins have been noted in Kuppam on the Mysore border and Ramgiri in the Anantapur district.

## NON-METALLIC MINERAL DEPOSITS

Of the mineral fuels, coal bearing rocks of Barakar age have been found in the Godavari Valley in Beddanuru, Tottapalli and in Lingala.

The Geological Survey of India put two bore-holes in 1942-'43 at Beddanuru to a depth of 350 feet. It is considered that a few more bore-holes would help to throw light on the extent of the deposits. At Tottapalli, the coal bearing rocks occupy an extent of 16 square miles, half of which may contain workable coal. The Lingala field is also said to contain a reserve of a few million tons.

Lignite occurs in South Arcot, Tanjore, South Kanara and Malabar. The South Arcot occurrence, in an area of some 25 sq. miles with a possibility of extension, is being investigated by the Government of Madras. The total reserves are estimated at 498 million tons.

*Industrial minerals*: Chrysotile asbestos occurs between Brahmanapalle and Lingala in Pulivendla taluk in the Cuddappah district. The veins are up to 5 or 6 inches thick though $\frac{1}{2}$ inch thick veins are very common. It has been estimated that 2.5 lakhs of tons are available round about this area.

The Nellore deposits of *mica* are fairly well known. The mica pegmatites are sometimes as thick as 300 feet running to lengths of 1,500 feet. Nellore mica is of a light pale green colour, while Kalichedu mica contains the ruby variety also. Mica-bearing pegmatities have been found in West Godavari, Wyanad in the Nilgiri district, Salem, Coimbatore, Madura, Tiruchirapalli and Tirunelveli districts. However, there has not been any systematic prospecting of these deposits in Tamil districts.

About 25 per cent of India's production of mica is obtained from Nellore mica belt. There is considerable scope for getting more mica from many of the abandoned mines which have after all been scratched only on the surface, by crude methods. Further there is need for detailed investigation along the coastal tract of Nellore, to discover the concealed occurrences.

The important sources of barytes in the province are in the Cuddappah, Anantapur and Kurnool districts and the mineral is mined at Pulivendla and Vemula in the Cuddappah district. Baryte veins up to several feet thick occur in the limestones and traps. Other mining centres are Nerijumapalle and Muttssukota in the Anantapur district and Balapalapalle in the Kurnool district. There are also baryte veins in Neravada in the Nellore district and at Alangayam in Salem. Rayalaseema is the main source of barytes in India. The figure of 29,000 tons of barytes to the value of 3.6 lakhs of rupees mined in 1947 indicates the continual increase in the production of this mineral.

*Ceramic materials*

Among Koalin deposits have been located in Nellore, Malabar, S. Kanara, and South Arcot districts. Clays of different kinds and of

different geological age are distributed throughout the province. Their suitability for specific purposes such as the manufacture of firebricks, tiles and stone-ware has to be studied. There is plenty of resources of quartz and feldspar in the granitic gneisses, occurring in many districts of the province.

*Abrasives*

The most important deposit of corundum is located in Tiruchengodu, Namakkal, Dharmapuri and Hosur taluks of the Salem district. The first one is still being worked and has an output of only 50 to 60 tons a year. Corundum has also been reported from Dharmavaram and Hindupur taluks of the Anantapur district, Uppinongudi in the South Kanara district and from Kangayam in the Coimbatore district.

Garnet sands occur in large quantities in the coasts of Tinnevelly and crystals in the schists of the Nellore mica belt, whereas no natural emery has so far been discovered; while artificial emery is being made at Yercaud.

Of the refractories, magnesite and chromite have already been mentioned. Graphite has been worked near Zangareddigudem in the West Godavari district, in Sitapalli Chodavaram of East Godavari, and at Pudukkulam in the Tinnevelly district.

Among fertiliser minerals about two million tons of impure calcium phosphates occur within a depth of 50 ft. in an extent of 12 sq. miles, round about Karai in the Tiruchirapalli district. A small apatite deposit has been located at Sitaramapuram 25 miles north-west of Vijayanagaram. It has been estimated that about 5,000 tons occur in this locality, within a depth of 30 feet from the surface.

*Minerals for Chemical Industries*

Celestite, the sulphate of strontium occurs with gypsum in the cretaceous rocks of Tiruchirapalli. The gypsum reserve in this area is estimated to be 3 million tons for a depth of 50 feet. Other sources of gypsum are the marine silts near Sulurpet in the Nellore district. Pyrrhotite with 20 to 25% of sulphur content occurs in Polur in the North Arcot district. The load was worked by a private company but is now abandoned.

Among gemstones the only important occurrence of diamond is in Vajrakarur (Anantapur district) and in the neighbouring places. Numerous occurrences of diamond were worked in the drainage basins of the Tungabadhra and Krishna rivers in Kurnool, Anantapur, Guntur and Hyderabad, in the 17th, 18th and early 19th centuries. Padiyur beryl and chrysoberyl are transparent enough to be prized as gems, the later are found at Kangayam. Corundum ruby occurs in Kadavur (Tiruchirapalli). Gem garnet has occasionally been found in Sankaridrug, Kondapalli and from the Nellore mica belt.

*Building Materials*

The charnockites or the blue granites find extensive use for various building purposes. The khondalites of Vishakapatnam, the calcareous flagstones known as the Cuddappah slabs from Rayalaseema and Guntur, the slates of Markapur, the Uttatur limestones and laterites have been used as building stones in this province. Abundant granite and gneisses, suitable for use are found in many districts of the Province. Cement is manufactured at Bezwada and Mangalagiri in the Krishna district and at Dalmiapuram (Tiruchirapalli).

This brief survey indicates that there are good potentialities of resources in this Province for industrial development.

# THE GREAT TEMPLES OF MADRAS AND SOUTHERN INDIA

BY

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*Commissioner, Hindu Religious Endowments Board*

It is not without just cause that the Madras Government have adopted the Gopuram, the typical temple structure of Southern India on their seal. For, in Madras and the adjoining states the great temples which are characteristic of the worship of the Supreme Deity in modern Hinduism, have been preserved in their pristine beauty and glory as nowhere else in India. No doubt from the 12th Century onwards the whole country has been ravaged by the Mahommedans upto the sea at Rameswaram. They ruled over the greater part of Southern India for centuries during the intervening period of time. Yet the Mahommedan conquest of South India is of a different type from their domination of Northern India. From the time of the Arab conquest of Sindh, right up to the last invasion of Ahemedshah Durani in 1761, the Mahommedans from Arabia, Persia, Turkestan or Afghanistan settled in the conquered country in thousands in North India and dominated the life of the country. The result was that the Hindus in the north gradually imbibed many of their manners and customs.

But, when the Mahommedans came down to the South, the situation was entirely different. By their superiority in cavalry and fire arms combined with their religious fanaticism, they could rout the armies of the Hindu rulers in the battle field. But they knew from their experience in Northern India that mere victory in the battle field cannot lead them very far. The conquerors suffered as much as the conquered if the people were not assured of their safety in the pursuit of the ordinary avocations of their life. Added to this they were in a helpless minority in the country cut off from their base by long distances across which communications were difficult at all times, and, for months together during the rainy season, well-nigh impossible.

It has thus happened that from the time of the great Asafjah, Nizamul-Mulk, the founder of Hyderabad State till the days of Mahbul Ali Khan, the father of the present Nizam, Hindu Rajahs and Deshmukhs had an honoured place at the court of the Nizam on a footing of perfect equality with the Mahommedan subedars and noblemen. The Mahommedan rulers did not interfere with the religion or the religious institutions of their Hindu subjects. A good few of them even took pride in building Hindu temples and endowing them.

It should also not be forgotten that there are some considerable portions of Southern India which were never under the rule of Mahommedans and over vast portions of the country, their sway was only nominal. Tanjore was never under the Mahommedans at all throughout its history and this explains the existence even today the largest number of richly endowed temples and mutts in South India. Travancore, Cochin and Malabar were under the Mahommedans only for a short period under Tippu and here again there are a large number of temples preserved in out of way places with their endowments intact.

Madras if anything, was a petty fishing village until the Rajah of Chandragiri gave it to the English East India Company for building a factory. The prospects of trade brought many merchants from the rich northern Districts who settled in the present George Town area and this is responsible for the existence of richly endowed temples in this area. The Chennakesava and Chennamalleswaraswami temples were built by the merchants in the old fashion of Chola Rulers, showing equal devotion to the great deities of modern Hinduism, Vishnu as well as Shiva. Then we have the Kanyakaparameswari temple, dedicated to the Patron Goddess of the rich Vysia community who according to tradition immolated herself in the fire to save her virginity from the improper attentions of a vicious ruler. The Beri chetties Telugu merchants, not belonging to the Vysia community, have a temple of their own in this area, dedicated to Sri Kandaswami, the son of Shiva the great Warrior God who led the inhabitants of Heaven to victory in their fight against the Rakshasas.

But these are comparatively minor temples from the architectural points of view, although their endowments have now appreciated in value a hundred fold and a thousand fold and court schemes have ordered diversion of some of their surplus funds for educational and charitable purposes. Within the present limits of Madras City, one of the biggest temples is the Parthasarathy Temple of Triplicane, originally a Vaishnavite Agraharam. It is dedicated to Lord Sri Krishna, the Sarathi or Charioteer who piloted the greatest soldier among the Pandava brothers, Arjuna, to victory in the great Mahabharatha war. This temple has a very large number of endowments from all sections of the Hindu community.

The most ancient temple in the City is the Kapaleswaraswami temple, in Mylapore dedicated to Shiva, and is one of great "Patal-sthalams" of Shaivite tradition. The Shaivism of Tamil Nad has an indigenous and independent growth, and outside Hinduism based on Sanskrit Texts, there are four great Shaivite Saints namely Appar, Sundar, Manikkavachakar and Gnana Sambandar honoured throughout South India, below Madras. Like all great apostles they went from place to place among those known in their days, singing the glory

of the Lord wherever they went and preaching more by their example than in words. There are said to be about seventy of those Patal-sthalams in Tamilnadu sanctified by the holy fact of these Saints and Mylapore is one of them.

Mylapore has also the glory of being the birth place of Tiruvalluvar, the great Tamil Bhakta who wrote the book of wisdom, the Tirukkural. According to tradition, he carried on the humble avocation of a spinner and weaver all his life near the place where there is now the "St. Mary's Church".

Since Madras occupied only an insignificant place in the life of Tamilnadu during the days of its glory the great temples worth seeing are not in Madras though they are near Madras in some of the old Chola and Pallava Capitals. The unique temple at the old Pallava Capital 'Mahabalipuram', which is really a corruption of Mamillapuram according to inscriptions, is about 40 miles from Madras and exhibits one of the peculiar types of Pallava achitecture, a whole temple hewn out of a single rock, though it is not on the scale of the cave temples at Ellore or Ajantha. The beautiful stone chariot similarly hewn out of a single block of stone, traditionally known as "Arjuna's Chariot" deserved to be seen by any one who prodes himself on the glories of Indian Sculpture and Art.

Next in importance is the sacred temple at Tirukulikundram on the way to Mahabalipuram where one can see the "Sacred Kites" that are said to traverse the whole of India from Benares to Rameswaram between sunrise and sunset. The most ancient shrine here is that dedicated to 'Chaturmukha Brahma' Brahma with 'Four Faces' on a small hillock.

The old Chola Capital "Conjeevaram" is only about 50 miles by car or train from Madras and its grand temples reveal on what scale the ancient rulers and sculptors could plan and execute. The great temple of Ekambareswaraswami is certainly one of the oldest Shaivite temples in Southern India, though the 'Kamakshi Amman' temple must have been much older. This is attested by the fact that in scores of villages in the country round about, from the northern Pennar to the southern Pennar, the presiding deity in many Shaivite temples in Ekambareswara and the female deity is Kamakshi Amman. But in recent times the great Varadarajaswami temple a more recent Vaishnavite one attract more pilgrims, even from remote Rajaputana.

It is impossible to describe all the temples big and small of Conjeevaram, which may be indeed called the 'City of Temples'. The 'Kailasanatha' temple which contains some of the finest sculptures of the Pallavas, deserves special mention, as one of the oldest types of temples in Southern India. Its structure, so closely resembling that of the Buddhist Viharas, clearly shows the Buddhistic origin of our South Indian temple architecture, though Buddhism is nowhere followed now.

On the way to Conjeevaram, is Sriperumbudur, the birth place of Sri Ramanujacharya who is the founder of modern Vaishnavism. While Sri Sankaracharya is honoured throughout India as the author of Hindu revival who stamped out Buddhism from the land of its origin, great credit is due to Ramanujacharya as the great commentator, the Bhashyakaraswami whose exposition of the great truths of Hinduism made them more easy to grasp by the ordinary man. There is a temple dedicated to him here, in the very temple of Adikesavaperumal where he is stated to have himself worshipped Vishnu the supreme Being in the form which he popularised.

Though there are many more temples that are worth mentioning still any visitor who sees Tirukulikundram and Mahabalipuram, the great temples at Conjeevaram and Sriperumbudur would have some real idea of the grandeur and glory of South Indian temples. If he can command leisure he ought to see Sri Arunachaleswara temple at Tiruvannamalai, Sri Ranganandhaswami at Srirangam in the mid-stream of the Kaveri, Sri Meenakshi, the patron Goddess of the Pandya Rulers of Mathurai, as well as Sri Rameswaram at one side of the extreme South where Sri Rama worshipped Shiva before and after his conquest of Ceylon and end his tour with a sight of the Virgin Goddess Kanyakumari at the tip of the Peninsula. Then he would have seen real Hindu India at its best and would be inspired with a new love of this glorious Bharatavarsha and a new zeal to spread far and wide, in all the four quarters of the globe, her religion of love and peace, of assimilation and toleration, embodied also in the life and martyrdom of the latest of her great Saints, Mahatma Gandhi.

# ZOOLOGICAL GARDENS

(CONTRIBUTED)

The Zoo is one of the amenities provided by the Corporation of Madras for the benefit of the people of the city. The Zoo is situated in a spacious garden in the northern part of People's Park and is easily accessible from all parts of the city by bus, tram or train. A small lake with an island formed in the middle of it renders the appearance of the garden picturesque. The edges of the lake are provided with ornamental fencing and the island is reached by two pretty wooden bridges, the reflections of which on the placid waters of the lake lend a spectacular effect to the whole scenery. The lake affords facilities for boating. There is a boat-house by the side of the Zoological garden, and pleasure boats ply for hire on the lake round the island.

The Zoo was originally called the Menagerie and it was started in the year 1853 as an adjunct to the Government Museum at Egmore. When the People's Park was opened in the year 1861, it was shifted there. In the year 1866 it was handed over to the Madras Corporation and it remained under the control of the President of the Corporation till 1917 when it was transferred to the charge of the License Officer. From 1921, its management came to be vested with the Health Officer.

In 1930 it was extended and improved at a cost of Rs. 33,600. Architectural gates were provided at the main entrance and the enclosures for animals were re-modelled so as to afford more accommodation and provide as much natural environs as is possible to the animals. It was from this year onwards that the Zoological garden came to be called as such after the London Zoological Garden. Further improvements such as revetment of the banks of the lake, erection of ornamental walls and the remodelling of the garden lay-out have been carried out in subsequent years.

From the artistic main entrance well-laid roads lead to the various cages and sheds inside. The roads bordered by grass-lawns and flowerbeds present a pleasing appearance. Their lay-out has been so designed as to enable even invalids to approach the enclosure in conveyances of their own and view the animals at close quarters. The grass-lawns are studded with shady trees, which afford shelter to the visitors especially during summer. There are also resting sheds for the convenience of visitors, and a canteen centrally situated provides light refreshments. To entertain the visitors arrangements have been made for playing the Corporation Band. The existence of these facilities makes the Zoological Garden an ideal place for arranging excursions and holding picnic parties.

The Zoological Garden is open from 6-30 a.m. to 6-30 p.m. on all days and admission is regulated by a nominal fee of two annas for an adult. Elementary school children are admitted at a concessional rate of an anna for a child. Visitors can have joy rides on elephants for a fee of 4 annas per head. Elephants and camels are also hired out to the public for use on ceremonial occasions. When letting out them for such purposes, the animals are decorated with ornamental trappings which make a colour show. Boats plying on the Zoo take visitors round the island on payment of a fee of 2 annas per head per round.

A Superintendent with an Assistant Superintendent, two sergeants and a staff of animal-keepers is in immedate charge of the Zoological Garden. The health of the animals is looked after by the Corporation Veterinary Officer.

The Zoological Garden contains a rare collection of animals. In the year 1942, the city was threatened with imminent danger from aerial bombardment, and all the carnivores had to be shot as a measure of safety to the public under the orders of the Provincial Government. Among the animals shot dead was a unique pair of a tiger and a lioness reared together from their infancy. The other animals were removed to Erode for safety and they were brought back in the year 1944 when the city was considered to be free from danger.

The Corporation has ever since been endeavouring to replenish the Zoo with rare animals and within a period of 4 years many rare and costly animals have been acquired. The varieties of animals now available in the Zoo provide the utmost diversity to the visitors and the popularity of the Zoo has been revived.

Notable among the animals are the lions, tigers, leopards, panthers, camels, elephants, gibbons, giraffes, nilgai deer, sambhar deer, zebras, emus, crocodiles and pythons. Amidst the many shady trees in the island are the aviaries for birds, cages for monkeys and enclosures for reptiles and acquatic birds. One male black hoolock gibbon and one female silvery gibbon and 7 macow parrots were received as gifts from H.E. the Maharajah of Bhavanagar, Governor of Madras and one black panther, 2 leopards, one tiger, three lions and five lionesses were received as gifts from the Saurashtra Government.

As a measure of economy and convenience the rights of collecting the entrance fees, running the canteen and plying pleasure boats on the lake have been let on contract for Rs. 61,500, Rs. 7,000 and Rs. 6,200 respectively for the year 1949-'50.

# THE AGRI-HORTICULTURAL SOCIETY OF MADRAS

BY

RICHARD APPEL, M.D.,

*Honorary Secretary, Agri-Horticultural Society*

The Agri-Horticultural Society, Madras, with Ornamental and Nursery Gardens in the midst of the city had its beginnings in the early part of the nineteenth century, due perhaps to a small group of people who were botanically minded and who were intensely interested in introducing new, interesting and useful plants into this city. The Society was founded in 1835 with Sir Frederick Adam the then Governor as its President. The objects of the Society were laid down as "Promotion of agriculture, arboriculture and horticulture including the introduction and propagation of new and useful plants of all kinds but more especially those which are likely in the event of successful introduction, to extend and improve the commercial resources of India and the promotion of a collection of the most valuable trees and plants of all countries that can be made to thrive in a tropical climate".

The Ornamental and Nursery Gardens of the Society now comprise about 20 acres which have been acquired by the Society from time to time in various ways but mainly as grant from Government for the promotion of the objects laid down and also by purchase from its own funds. The Society has been keeping up its activities in conformity with the objects laid down, through many ups and downs during more than a hundred years now, and many botanists, scientists and medical men of repute have actually helped all along.

More recently, i.e. during 1947-'48, the Society placed about 6 acres of its land in the eastern part of the Nursery Garden at the disposal of the Director of Agriculture for a diploma and research training course in horticulture started by the Agricultural Department. This portion under the charge of the Fruit Specialist has been laid out partly as a flower garden and partly as a fruit and vegetable garden.

More and more people are becoming garden minded and the membership of the Society has been steadily increasing and it has on its rolls now more than 400 of whom a good many are mofussil members. Besides other privileges, a member is entitled to obtain from the Society the full value of his subscription as plants during the calendar year. The Flower Show is an annual feature of the Society usually held during the first week of February and most of the gardens in Madras are represented by their exhibits of flowering and foliage plants and colourful annuals. About this time of the year gardens maintained by members in the city

are also judged and cups and prizes are given on the occasion of the opening of the Show, by His Excellency the Governor. Recently a new competition known as the "All-the-year-round-garden" competition has been instituted to encourage keeping up a garden in a good and trim condition during any part of the year.

The Ornamental Garden maintained by the Society is a popular resort for many people in the city who would like to get away from their office or business routine for a quiet and restful change. It is also a place where parties of school and college students come for on outing and incidentally pick up some botany and some knowledge and information about plants. This garden contains some fine old trees, many of them are of economic or special interest. There are trees like Mahagony, Teak, Trincomalie wood (Berrys), Chickrassia, Red Sandal wood (Pterocarpus santalinus), Acacia sundra, etc., which are of good timber value. There are others such as, Caesalpinea coriaria (Divi-divi), Sapendus emarginatus (soap nut), Schlichera trijuga (the Kusum which is a favourite host for the lac insect), Broussonetia papyrifera (paper mulberry), Guaiacum officinale (lignum vitae), Melaleuca cajaputi (cajaput oil), Sterculia urens (yielding a gum), Eucalyptus species and many others which find use in trade or commerce.

Of the flowering and ornamental kinds, the pink Cassia javanica and other Cassias, Peltophorums, Tabebuia rosea, Tecoma argentea, Erythrinas, Brownea coccinea, Lagerstroemia and flos-reginae, make a colourful display during periods of bloom. The Society is run by a Managing Committee of twelve members including a Chairman, an Honorary Secretary and an Honorary Treasurer. The Governor of Madras, is the President of the Society.

# THE THEOSOPHICAL SOCIETY

BY

SIDNEY A. COOK,

*Vice-President, The Theosophical Society*

At Adyar is situated the International Headquarters of the Theosophical Society covering 266 acres extending along the southern bank of the Adyar river to the sea. There are more than sixty buildings and the gardens contain many rare imported trees and plants, pleasant walks and fine views, making it one of the most beautiful park-like estates in South India.

The Theosophical Society is an International Organization founded at New York in 1875 and incorporated at Madras in 1905. The Headquarters were moved to Adyar early in 1883. The Founders of the Society were Madame H. P. Blavatsky and Col. H. S. Olcott.

*Past Presidents*: Col. H. S. Olcott, 1875 to 1907; Dr. Annie Besant, 1907 to 1933 and Dr. George S. Arundale, 1934 to 1945.

*Present President*: Mr. C. Jinarajadasa, M.A. (Cantab.) 1946 onwards.

The Objects of the Society are: 1. To form a nucleus of the Universal Brotherhood of Humanity, without distinction of race, creed, sex, caste or colour. 2. To encourage the study of Comparative Religion, Philosophy, and Science. 3. To investigate unexplained laws of Nature and the powers latent in man.

The Society has branches in more than fifty countries in the world, all working for Universal Brotherhood.

At the Headquarters estate at Adyar, in the great hall of the Society, are statues of the two Founders, and around the walls of the hall are symbols depicting the Great Religions of the world, past and present. Also on the estate of the Society are shrines of the various Religions, which members have built. These include a Hindu Temple, Buddhist Shrine, Muhammadan Mosque, built on the lines of the famous Pearl Mosque in Agra, Zoroastrain Temple and Christian Church. From all over the world members of the Society come to Adyar and all these faiths and most others are represented among them. This is in accordance with the Society's second object.

One of the important aspects of the work of the Society is that of the Adyar Library founded in 1886 by the President-Founder. In the Library are now some 15,000 manuscripts (10,000 palm-leaf, 4,000 paper, and 1,000 transcripts bound as books). It also houses the Mahamahopadyaya Dr. V. Swaminatha Iyer's collection of a thousand Tamil manus-

cripts. Donors from abroad have given rare and interesting volumes in many languages, Swedish, Russian, Finnish, Greek, Italian, Spanish, Portuguese, and French. Collections of books in the Indian languages as well as those of the Far East—Burmese, Annamese, Siamese, Sinhalese, Chinese and Japanese, make the Adyar Library one of the most diversified libraries, not only in language but also in subject matter. Many thousands of visitors come to the Library to see its collection of manuscripts—copper engraved and overlaid, silk and silk paper, palm-leaf, etc. One of the most important activities is its translation and publication of the hidden treasures in palm-leaf and other manuscripts in its Adyar Library series and journal *Brahmavidya.*

The great Banyan tree receives many visitors daily. It is said to be one of the three largest in the world, measuring from north to south 200 ft. and from east to west 160 ft. It has been the centre of many notable gatherings of the Theosophical Society and during Dr. Besant's time many thousands attended meetings under its shady branches.

The Garden of Remembrance is regarded by many people as a shrine of National importance. Here was committed to the flames the body of Dr. Annie Besant, a great pioneer of India's freedom, who played such a prominent part in the country's development. She was President of the Society from 1907 to 20th September 1933, and many visitors come to offer their homage at this sacred spot. The ashes of Bishop C. W. Leadbeater, a co-worker of Dr. Besant are scattered here. Dr. George Sidney Arundale, another co-worker and the successor of Dr. Besant as President of the Theosophical Society was also cremated in this garden.

The Society has its own printing house (Vasanta Press) and publishing house (The Theosophical Publishing House) where books and journals of Theosophy and allied subjects are produced and distributed to many countries. Each month the Society's journal, *The Theosophist,* is printed under the editorship of the President of the Society.

The Adyar estate is run as a community with departments caring for the needs of the workers resident on the estate. These include Laundry, Engineering Department and Hostels for both western and Indian type living. Many members of the Society from overseas come to take part in the work or to study at the Headquarters, making it a truly international centre.

# THE KALAKSHETRA

BY

R. SRINIVASAN,

*Joint Director, The Kalakshetra*

Kalakshetra was founded in January 1936 by Srimathi Rukmini Devi, whose ardent hope has been that this Centre may help to revive throughout India the true spirit of Arts, so that India's reawakened freedom may become real through the rebirth of the age-old Indian culture in every Indian home. Without culture there can be no real freedom, just as without freedom there can be no true culture. Both must go together if there is to be in the real sense a freedom of India's soul. She also hopes that through this Centre the highest culture of the East and West may be drawn together, for beauty is above all distinctions of race, of nation and of faith.

It was originally called the "International Academy of the Arts", but the name was later changed to the present Sanskrit form, which means the "sacred abode of the arts". The influence of Kalakshetra on contemporary art has been tremendous. The dance art began to take a new lease of life thereby wiping away the age-old prejudices.

Kalakshetra exacts from its students a very high standard. They have to go through a strenuous course of 4 years study and practice, and even then only those who achieve the prescribed level are awarded diplomas.

In the early stage Kalakshetra concerned itself mainly with Bharatanatya. Students were attracted from all parts of the country but there was an almost insurmountable initial difficulty which had to be met. The knowledge and the technique of teaching and composition was in the hands of a few and was regarded by them as a jealous privilege. These teachers lacked vision and intuition and contented themselves with mechanically carrying on the tradition they received from their fathers. The result was that there was no inspiration which is so vital to any art. Srimathi Rukmini Devi rebelled against this state of affairs and this institution under her guidance composed its own dances on new themes and also explored the vast treasure house of music suited to the dance. Dance dramas of the past like "Kutrala Kuravanjee" and "Kumarasambhavam" were produced.

Soon after Kathakali was added to the curriculum; some of the best experts from Malabar came to train the young people in the art. In 1945 an entire Kathakali play was produced, in which the obvious and glaring crudities which had invaded the art were removed, keeping at the

same time the spirit of the art and the traditional music and accompaniments.

In India, Dance and Music have been almost inseparable. The very definition given to Music in the ancient books included music, dance and instrumental accompaniments. And so, side by side with Dance, music also is being taught to a very high standard. In 1944 the Sangita Siromani course of the Madras University was started and this institution has already produced its first graduates. The institution is also running a parallel course for those who, while showing great aptitude for music, do not wish to be constrained by the regulations of the University. Some of the subjects not required particularly for proficiency in music are omitted from this course and the time so left over is given to more intensive training in music.

Kalakshetra is specially interested in the preservation of those indigenous arts for which India is so justly famous. The weaving section attached to the Institution, produces beautiful saris and other fabrics for which there is a demand all over the country. In fact, the demand is so great that it is not always possible to meet it. It is hoped that it will soon be possible to build up a model village for artisans who are experts in their several lines, and thus save many of these exquisite crafts from dying out.

A religious spirit pervaded the entire life of Kalakshetra. Religion is understood and is not expressed in a sectarian manner. Insistence is laid upon the essential unity of all human aspiration that finds its expression in religion and on that spirit of dedication which really is the basis of true religious impulse and of all creative work. The whole of Kalakshetra seeks to be a home, a home where the members of the family study their several arts, and where the home idea prevails in all aspects of life and study.

India to-day is building herself anew but the rebuilding will never be effective unless we rediscover ourselves and the spirit that made India great in the past. It is with the idea of discovering and emphasizing values that are eternal so that the future of our country may be greater than her past, that Kalakshetra has been founded.

## MESSAGES RECEIVED FOR THE CONFERENCE

[Several messages have been received from distinguished statesmen, public figures, and Scientists in India and abroad wishing the 16th Conference of the Indian Mathematical Society a success. Some of these messages are reproduced below:]

International Congress
of Mathematicians

Harvard University
Cambridge 38, Mass.
December 15, 1949

It gives me great pleasure to send greetings to the Indian Mathematical Society on the occasion of its Sixteenth Conference at Madras. Indian mathematics is playing a role of steadily increasing importance in world science, and it is a source of stimulus and encouragement to American mathematicians to watch this development.

May I take this opportunity to express the hope that a number of India's leading mathematicians will find it possible to attend the International Mathematical Congress being held at Harvard next year? I have already corresponded briefly concerning this with my good friend, Professor Kosambi. The formal invitations have just been sent out by the American Mathematical Society to universities all over the world, and I plan to write another letter soon regarding detailed arrangements, to find out what are the possibilities for participation from India. I wonder if it would be possible for the Council of the Indian Mathematical Society to discuss this matter during the coming meeting.

Very cordially yours,
GARRETT BIRKHOFF
*Chairman, Organizing Committee*

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11, Old Square
London, W.C. 2
England

Dear Mr. Rajalakshman,

I am indebted to you for your letter and invitation to the Sixteenth Conference of the Indian Mathematical Society and only regret that I cannot be present. It is nearly 50 years since I was able to take an active interest in mathematics. But I still retain my membership of the London Mathematical Society and have pleasure in sending my congratulations and good wishes to your sister society.

Sincerely yours,
PETHIC LAWRENCE

Blegdamsvej
15, Copenhagen
Denmark

To

The Indian Mathematical Society

I thank the Society very much indeed for the great honour shown to me by inviting me to be present at the inauguration by your great scientist Sir C. V. Raman. I regret very much that I shall not be able personally to come. At the same time, however, allow me to send my best wishes for the congress and to express my hope or even certainty that the congress with its large and most interesting looking program will be of great value for the development of the Mathematical Science whose roots go back to the oldest history of mankind.

HARALD BOHR
Copenhagen

---

31, Pond Street
Hampstead, N.W. 3.
Telephone Hampstead 5908
Dec. 15th 1949

Dear Sir,

Thank you for your letter. I wish the Indian Mathematical Society every success in its forthcoming Conference.

Yours faithfully,
JULIAN HUXLEY

---

*John College, Cambridge* 14-12-49

Local Secretary,
XVI Mathematical Conference

Dear Sir,

I send my greetings and best wishes to the Indian Mathematical Society on the occasion of its Sixteenth Conference.

How unfortunate are we Mathematicians to find in the present difficult times a never-ending source of joy and pleasure in the study and advancement of Mathematics! May your Society long and successfully continue to make its contribution to our common welfare.

L. J. MORDELL

14th December 1949

Regrettant vivement que les distqnces qui nous separent m' interdisent d' assister a votre seance du 26 December, je salue en la Souiete Mathematique Indienne la vaillante heritiere des traditions qui ont fait de votre pays le berceau de la pensee Mathematique.

Je salue aussi l' union de la Mathematique et de la Physique, symbolisee par le role devolu dans l' inauguration de votre XVI[e] Conference, a l' un des plus qrands Maitres de la Physique contemporaine.

HADAMARD
Paris

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PRINCETON UNIVERSITY
PRINCETON NEW JERSEY

Department of Mathematics

Fine Hall
Box 708
Princeton, N.J.
December 16, 1949

Dear Sir,

It is a great pleasure and honour to send fraternal greetings to a gathering of mathematicians in the land of Ramanujan and to wish it success and progress in its lectures and other activities.

Mathematics is the most ancient craft of the mind, always active, and at some times and in some places more so than in others; and it appears that a strong renascence of it is taking place in your country, with the present mathematical generation being as discerning and alert as in any other mathematical community known.

On the face of it there may be some exaggeration in the modern mathematical approach of finding a multitute of definitions, concepts and other structures first, and of examining their intimate relations and the inside contents of their substance only afterwards. But most likely this is only another version of the old Pythagorean dream of encompassing the universe with a structural framework first and then filling it in with geometry, numbers and other like objects afterwards.

So, on to a good meeting,

Yours faithfully,
S. BOCHNER

---

4 Capel Close
Oxford
13-12-49

Best wishes to the Indian Mathematical Society for the success of the Sixteenth Conference.

E. C. TI TCH MARSH

Sir Edmund Whittaker
48, George Square
Edinburgh 8

Dear Mr. Rajalakshmanan,

Thank you for your kind letter and the notice of the XVI Conference of the Indian Mathematical Society to be held at the end of this month. It is a great pleasure to think of the keen interest in Mathematics which is now so conspicuous in India and the excellent research work that is being published by the Members of the Indian Mathematical Society. May I send my most friendly greetings and good wishes for the success of the Conference.

Yours most sincerely,
E. T. WHITTAKER

---

P. C. Mahalanobis, F.R.S.

Statistical Laboratory
Presidency College
Calcutta, 7
32, Western Court
New Delhi
16th December, 1949

Dear Sri Rajalakshman,

I thank you for your kind invitation of the 11th December 1949 to attend the Sixteenth Conference of the Indian Mathematical Society on the 26th December 1949 in Madras. I regret, owing to other engagements, it is not possible for me to be present. I, however, send my greetings to the members of the Conference, and with best wishes for a most successful session.

I remain,
Yours sincerely,
P. C. MAHALANOBIS

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University College,
London, 18-12-49

I send greetings and good wishes for the success of the Sixteenth Conference of the Indian Mathematical Society.

L. S. BOSANQUET
*Reader in Mathematics in the University of London & Hon. Secretary of the London Mathematical Society*

Your letter Eleventh December. Unable attend Conference. Please convey my good wishes for its success.

DR. BHABHA

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Cordial greetings to the members of the Sixteenth Conference of the Indian Mathematical Society. May the Society continue to render the same high service to mathematics as in the past respectfully.

L. E. DICKSON

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On the occasion of Sixteenth Indian Mathematical Conference, the Statistical Laboratory, the University of California and Staff wish express admiration for the splendid Research Mathematics in general and in Mathematical Statistics in particular done in India. Best wishes.

J. NEYMAN

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University of Cambridge
Department of Genetics

Whittingehame Lodge
44, Storey's Way,
Cambridge, England
13th December, 1949

Thank you for letting me know of the Indian Mathematical Society's meeting in Madras. It is, of course a pleasure to send you a line with my good wishes.

Yours sincerely,
R. A. FISHER

---

Governor
East Punjab

Barnes Court
Simla
December 21, 1949

Dear Mr. Rajalakshman,

Thank you for your letter of the 13th December.

I send my greetings to the Sixteenth Conference of the Indian Mathematical Society which is meeting in Madras on the 26th December and wish it a great success. The Indian Mathematical Society has, I know, a great deal of first class work to its credit and I myself remember how, as a layman, I greatly enjoyed attending the Nagpur Session of the Conference about 20 years ago. May the Society grow from strength to strength and may Indian Mathematicians bring added lustre to our country in the field of Mathematics.

Yours sincerely,
TRIVEDI

Governor
United Provinces

Governor's Camp
United Provinces
18th December 1949

Dear Sir,

You have asked me for a Message for the Sixteenth Session of the Indian Mathematical Conference. Mathematics constitute a very valuable training for the mind and have a practical application in many fields of human endeavour. India has contributed much to the development of the Science and I hope the Conference will achieve valuable results.

Yours truly,
H. P. MODY

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Governor
Bihar

Governor's Camp
Bihar
17th December 1949

I am very glad to hear that the Sixteenth Indian Mathematical Conference opens on the 26th December 1949. This Indian Mathematical Society has been doing very useful work since it was founded in 1907. With the independence of India, this Society should develop and be in a position to give a lead to other countries in the sphere of mathematical researches. India is now recognised as the motherland of the science of mathematics, and it had in the past produced mathematicians of whom the mathematical world still feels proud. It am sure that under the patronage of free India this science will grow and the country will be able to produce not one but many Ramanujams, Barahamihirs and Aryabhattas. I wish all success to the Conference, and shall look forward to hear about its progressive activities from time to time.

M. S. ANEY
*Governor of Bihar*

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Governor
Central Provinces and
Berar

Governor's Camp
Central Provinces and
Berar
16th December 1949

I wish the Sixteenth Conference of the Indian Mathematical Society, which opens at Madras on the 26th December, all success and trust that its labours will add still greater lustre to the achievements of Indian Mathematicians and to the keen aptitude, probably unequalled in any other country of the world, which we have for mathematics and mathematical problems.

MANGALDAS PAKVASA
*Governor, C.P. and Berar*

Governor
Bombay

Government House,
Bombay 6
December 1949

I have much pleasure in sending my good wishes to the Sixteenth Conference of the Indian Mathematical Society. We should be proud of the valuable contributions which India has made since times immemorial to the development of mathematics, and I hope that the Indian Mathematical Society will endeavour to sustain that great tradition.

MAHARAJ SINGH
*Governor of Bombay*

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Governor
Orissa

Government House
Cuttack
17th December 1949

Some imagine the Power behind this problematic Universe to be a Geometrician and others see in it the matrix of numbers and their incalculable relationships. Nagarjuna discovered the all-powerful being in Shunya or the Almighty Zero. I would be most curious to know what you think.

I wish your Society all success.

ASAF ALI
*Governor of Orissa*

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Ministry of Education,
India

New Delhi
17th December 1949

Dear Sir,

On the occasion of the Sixteenth Indian Mathematical Conference I send you my best wishes for a successful session. I hope the Conference will stimulate study and research in the Mathematical Science in India so that our country may take its rightful place in the rank of countries contributing towards the development of mathematics. India had a glorious past in the field of Mathematics in ancient times and it is my earnest desire that through your efforts it may attain the same reputation again.

Yours sincerely,
TARA CHAND

---

Council of Scientific and
Industrial Research

New Delhi
14th December 1949

Mathematics is of considerable importance in furtherance of scientific research and India is rightly proud of her mathematicians who have won world wide fame. I hope the deliberations of the Sixteenth Conference of the Indian Mathematical Society will result in greater interest in mathematical studies and research. I wish the Conference every success.

S. S. BHATNAGAR

Apollo Pier Road
Bombay 1
15th December 1949

To The Mathematicians

[Assembled in Madras for the Sixteenth Conference of the Indian Mathematical Society.]

I convey my best wishes for a successful meeting. During six years of war, India was cut off from the great centres of learning in our subject and the development of mathematics in this country could not yet recover from that isolation. Again our research activities are hampered by the economic crisis and by currency restrictions. The access to foreign literature which is a vital necessity for our work and contacts with foreign scholars have become extremely difficult. The more importance has to be given to collaboration among the mathematicians of this country. I had the privilege to attend your meetings at Lucknow, Hyderabad, Aligarh, Annamalainagar, Delhi and Waltair and I am sorry not to be able to collaborate with the present Conference. May plenty of good mathematics result from the discussions in Madras.

F. W. LEVI

---

Premier
Government of Bombay

Secretariat,
Bombay,
22nd December 1949

Dear Shri Mudaliyar,

I thank you and the Reception Committee for your kind invitation, and wish the Sixteenth Conference of the Indian Mathematical Society, to be held under your auspices, the fullest success in its undertakings.

The role of Mathematics in the progress of the sciences, which are so rapidly transforming the modern world is immeasurable. Our country has, from the earliest times, made valuable contributions to this most fundamental of sciences; and I have no doubt that out of conferences such as yours, our countrymen will gather added stimulus and inspiration for even more valuable contributions than before.

Yours sincerely
B. G. KHER

---

Ragunath P. Paranjpye

I need not say how sorry I was to be able to stay over in Madras for the forthcoming conference of the Indian Mathematical Conference of the Indian Mathematical Society. I am sure that the conference will be a success when I see the brilliant band of mathematicians who are organising it. Madras is the province of India where the subject is most earnestly pursued and the present position of Indian Mathematical Society is largely due to Madras enthusiasm.

R. P. PARANJPYE

Premier
Assam

Shillong
16th December 1949

Dear Sir,

Your letter dated 13th December 1949 inviting me to attend the Sixteenth Indian Mathematical Conference to be held at 10-30 a.m. on Monday, the 26th December 1949 in the Senate House, University of Madras. Please convey my sincere thanks to the Reception Committee for the kind invitation.

Although I would very much like to associate myself with such a distinguished gathering, I regret my inability to do owing to various pre-occupations. Nevertheless I wish the Conference all success.

Yours sincerely,
G. N. BARDOLOI

# RECEPTION COMMITTEE

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Sir Rm. Alagappa Chettiar
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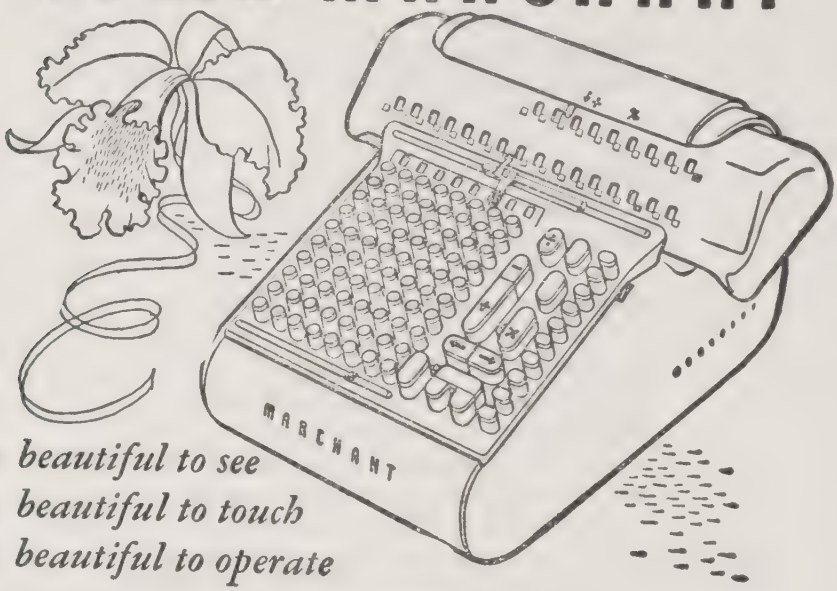


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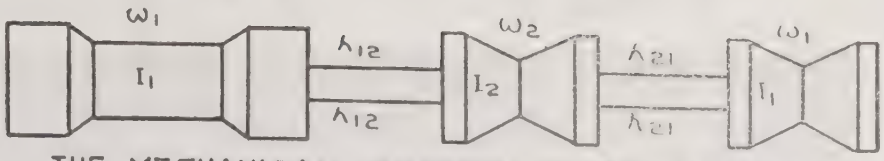


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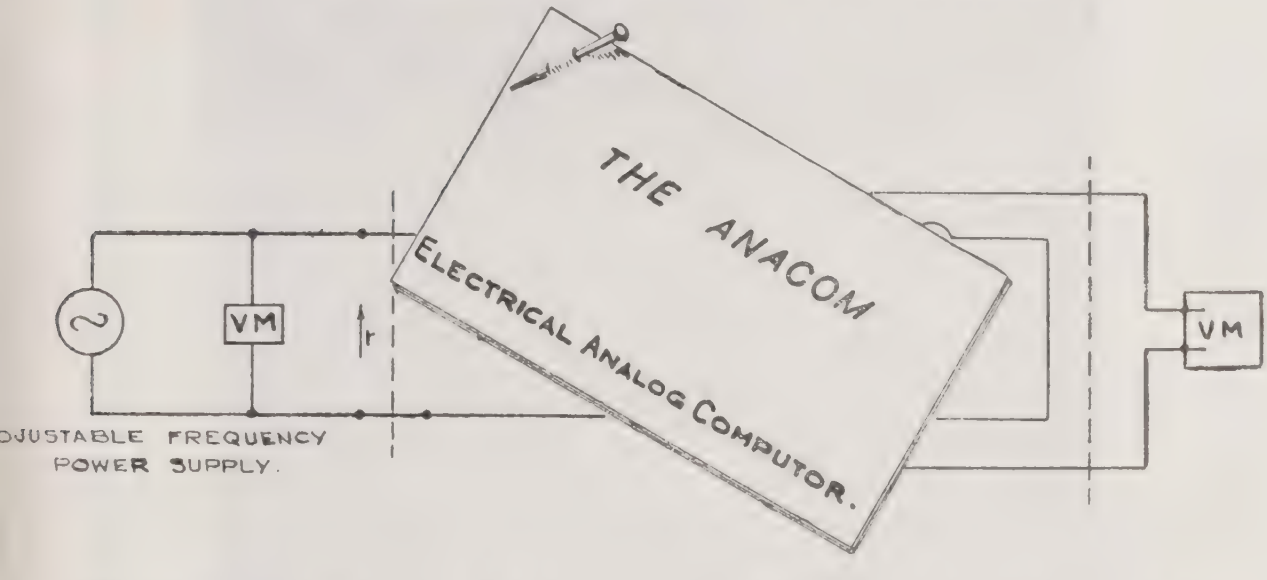


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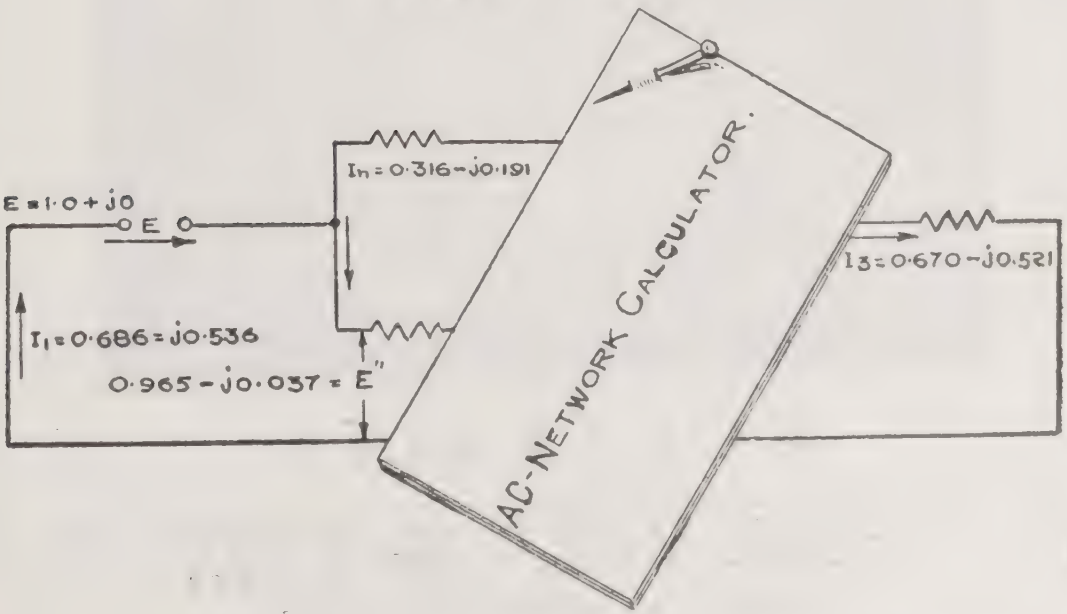


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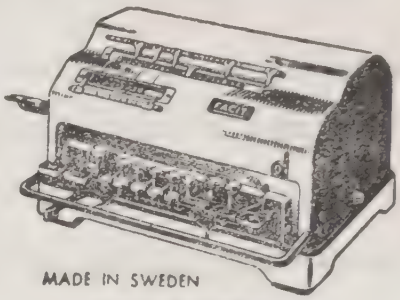


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